

## RUBIACEAE

茜草科 qian cao ke

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Trees, shrubs, annual or perennial herbs, subshrubs, vines, or lianas, infrequently monocaulous or creeping and rooting at nodes, terrestrial or infrequently epiphytic, with bisexual flowers, infrequently dioecious, or rarely polygamo-dioecious (*Diplospora*, *Galium*, *Guettarda*, perhaps *Brachytome*) or monoecious (*Galium*), evergreen or sometimes deciduous (*Hymenodictyon*), sometimes armed with straight to curved spines (formed by modified stems or peduncles), infrequently with elongated principal stems bearing lateral short shoots (i.e., brachyblasts; *Benkara*, *Catunaregam*, *Ceriscooides*, *Himalrandia*, *Leptodermis*, *Serissa*), infrequently with lateral branches or short shoots spinescent (i.e., prolonged, sharp, and leafless at apex), infrequently with reduced internodes that give an appearance of verticillate leaf arrangement (*Brachytome*, *Damnacanthus*, *Duperrea*, *Rothmannia*, *Rubovietnamia*), infrequently with buds resinous (*Gardenia*) or mucilaginous (*Scyphiphora*), infrequently with tissues fetid when bruised, [rarely with swollen hollow stems or leaf bases housing ants (*Neonauclea*)]; branchlets terete to angled or quadrate, in latter two cases often becoming terete with age, or rarely flattened (*Wendlandia*) or winged (*Hedyotis*, *Rubia*), buds conical or rounded with stipules valvate or imbricate, or infrequently flattened with stipules erect and pressed together (*Cinchona*, *Haldina*, *Nauclea*, *Neonauclea*). Raphides present or absent. Leaves opposite, verticillate, or apparently verticillate (i.e., closely set due to reduced internodes), decussate or occasionally distichous, petiolate to sessile, infrequently somewhat to strongly anisophyllous, rarely punctate- or striate-glandular (*Galium*); margins flat to occasionally undulate or crisped, entire or rarely lobed (*Hymenodictyon*, *Morinda*) to denticulate or serrate (*Hymenodictyon*, *Leptomischus*, *Ophiorrhiza*, *Wendlandia*); secondary veins pinnate or rarely triplinerved or palmate (*Hedyotis*, *Rubia*), free (i.e., eucamptodromous) or uniting near margins (i.e., brochidodromous) in weak to well-developed or rarely substraight submarginal vein, sometimes with foveolate (i.e., pitted or cryptlike) and/or tufted (i.e., pubescent) domatia (i.e., structures that house mites) in abaxial axils, these rarely also present in axils of tertiary veins (*Morinda*), with presence of domatia often variable within a species; tertiary and/or quaternary venation rarely arranged in regular squares (*Guettarda*), regular rectangles (i.e., clathrate; *Urophyllum*), or lineolate (i.e., closely parallel within each areole; *Timonius*); petiole rarely articulate at base (*Ixora*); stipules persistent with leaves, deciduous before leaves, or quickly caducous, interpetiolar and infrequently fused to adjacent petioles or leaf bases, sometimes united around stem into a sheath, rarely completely united into a conical cap (i.e., calyprate; *Gardenia*), with interpetiolar portion variously triangular in general shape to truncate, with apex entire or bilobed, multifid, lacerate, setose, or laterally appendaged, with apex, lobes, setae, and/or appendages sometimes glandular (*Chassalia*, *Hedyotis*, *Hymenodictyon*, *Knoxia*, *Mitchella*, *Mycetia*, *Neanotis*, *Ophiorrhiza*, *Pentas*, *Pseudopyxis*, *Psychotria*, *Trilliaedoxa*), internally (i.e., adaxially) with small to well-developed col-leters (i.e., glandular trichomes), these infrequently persistent after stipules fall (*Psychotria*), or stipules rarely expanded into 1 to several leaflike segments and then apparently absent due to leaflike form that gives an appearance of verticillate leaves (*Argostemma*, *Asperula*, *Galium*, *Microphysa*, *Phuopsis*, *Rubia*). Inflorescences terminal, axillary (i.e., borne at both axils at a node), or pseudo-axillary (i.e., borne consistently in 1 axil per node; lateral), sometimes apparently leaf-opposed due to marked anisophylly, or rarely superaxillary (*Damnacanthus*, *Diplospora*) or cauline (*Mycetia*), variously cymose to thyriform, corymbiform, paniculiform, racemiform, spiciform, fasciculate, or capitate and few to many flowered or occasionally reduced to a solitary flower, pedunculate (peduncle here used for basalmost axis supporting inflorescence or solitary flower) to sessile, when sessile often with 3 principal axes (i.e., tripartite), bracteate or bracts sometimes reduced or apparently absent, with bracts (here usually including bracts borne on pedicels or next to flowers, i.e., bracteoles) generally triangular to linear or sometimes leaflike (i.e., similar to normal or somewhat reduced leaves) and rarely enlarged, petaloid, and resembling calycophylls (*Dunnia*, *Neohymenopogon*), infrequently fused and involucrel, occasionally fused in pairs (i.e., forming a calyculus, or calyculate), infrequently thickened and spatulate to clavate or conical (genera of *Naucleae*), or infrequently stipuliform, rarely glandular (*Damnacanthus*, *Mycetia*), multifid to fimbriate (*Damnacanthus*, *Kelloggia*, *Spermacoce*) or spinescent (*Phuopsis*). Flowers sessile to pedicellate (pedicel here used for ultimate axis immediately supporting a single flower, except when this is a peduncle), bisexual and monomorphic, distylous, or rarely tristylous (*Chassalia*, *Pentas*), unisexual with 2 forms generally similar except for corolla size and hypanthium development, or rarely cleistogamous (*Ophiorrhiza*), actinomorphic or rarely zygomorphic (*Argostemma*), sometimes with ovaries of individual flowers partially to fully fused (*Mitchella*, *Morinda*, *Mouretia*, *Nauclea*), variously diurnal or nocturnal, usually sweetly fragrant, protandrous [or rarely protogynous], occasionally with secondary pollen presentation (e.g., *Ixora*, *Pavetta*, *Phuopsis*, *Scyphiphora*, genera of *Naucleae*). Calyx gamosepalous and fused to inferior ovary in hypanthium or ovary portion, this generally ellipsoid, turbinate, obconic, cylindrical, or occasionally subglobose to hemispherical, glabrous and smooth, pubescent, or rarely tuberculate (*Galium*) or with unusual flattened (*Dentella*) or hooked, sometimes glandular trichomes (*Galium*, *Kelloggia*), or rarely longitudinally ridged to winged (*Gardenia*,

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*Spiradiclis*), above this developed into a free limb portion, this limb variously tubular to cupular or infrequently reduced to obsolete (*Asperula*, *Coffea*, *Galium*, *Leptunis*, *Microphysa*, *Ophiorrhiza*, *Phuopsis*, *Rubia*), truncate to 4- or 5(-9)-denticulate (i.e., lobes reduced to tiny projections along a generally truncate margin) or shallowly to deeply 4- or 5(-9)-lobed, open in bud or rarely with lobes markedly imbricate (*Emmenopterys*, *Keenania*), [or rarely spathaceous (i.e., fused into a conical cap that splits irregularly)], inside variously near base and/or at sinuses between lobes with few to numerous small colleters, rarely densely or markedly veined (*Clarkella*, *Myrioneuron*, *Pseudopyxis*), rarely on margins with well-developed, sessile to stalked glands (*Mycetia*), lobes generally triangular to linear, occasionally obtuse to lanceolate or oblanceolate, or rarely prolonged into a slender shaft bearing a thickened apical portion (*Neonauclea*), occasionally slightly to markedly unequal on an individual flower with all lobes of different lengths or infrequently in unequal pairs of similar lengths (*Diodia*, *Mitracarpus*, *Spermacoce*), infrequently with 1(to 5, *Mussaenda*) lobe on some (or all, *Mussaenda*) flowers of an inflorescence enlarged into a calycophyll (i.e., a membranous to papery, petaloid, veined, white to colored blade borne on a generally well-developed stipe; *Emmenopterys*, *Morinda*, *Mussaenda*, *Schizomussaenda*). Corolla large and often showy to reduced, gamopetalous, white, yellow, orange, red, blue, purple, and/or pale green, when nocturnal often white at anthesis becoming yellow with age, variously funnellform, salverform (i.e., hypocrateriform), tubular, campanulate, or occasionally rotate to infrequently urceolate (i.e., swollen in basal part of tube; *Canthium*, *Lasianthus*) or inflated (i.e., markedly swollen in middle or upper part of tube; *Keenania*, *Leptomischus*), infrequently curved in tube and/or gibbous (i.e., asymmetrically swollen at very base of tube; *Chassalia*, *Guettarda*, *Mycetia*, *Ophiorrhiza*), infrequently differing in shape between long-styled and short-styled forms (*Antirhea*), infrequently markedly fleshy to leathery (*Caelospermum*, *Damnacanthus*, *Fosbergia*, *Rothmannia*, *Timonius*, *Urophyllum*), inside glabrous to variously pubescent with pubescence frequently confined to throat, outside infrequently ridged to winged (*Cinchona*, *Ophiorrhiza*), rarely fenestrate in tube (i.e., with longitudinal slits; *Damnacanthus*, *Paederia*), lobes (3 or)4 or 5(-11), shorter than or occasionally longer than tube, acute or less often obtuse to rounded at apex, generally spreading to somewhat reflexed at anthesis, infrequently with margins crisped to irregular, densely ciliate, and/or appendaged (*Cinchona*, *Luculia*, *Rondeletia*, *Saprosma*, *Serissa*), in bud imbricate (and usually quincuncial), valvate, valvate-induplicate, valvate-reduplicate, or convolute (i.e., contorted) to left or rarely to right (*Coptosapelta*, *Rothmannia*), usually with aestivation consistent within a genus, occasionally with wings, ridges, and/or rounded to hornlike thickenings or protuberances on back or at apex (*Lerchea*, *Ophiorrhiza*), rarely cucullate (*Lerchea*). Stamens adnate to corolla, free or rarely fused to stigma (*Acranthera*), alternate to corolla lobes and isomerous (i.e., equal in number to lobes) or rarely more numerous (*Gardenia*) [to rarely fewer], inserted variously in corolla throat, tube, or infrequently at base and sometimes appearing free (*Galium*), included to exserted, with point of insertion and position of anthers usually differing between long-styled and short-styled forms of distylous flowers, with staminodes of pistillate flowers generally similar to stamens but smaller; filaments well developed to reduced or obsolete, free or rarely coherent (*Argostemma*) or fused (*Acranthera*, *Argostemma*), variously glabrous to pubescent, occasionally markedly flattened (*Hymenodictyon*, *Kelloggia*); anthers free or rarely coherent or fused (*Argostemma*), 4-thecal or rarely 2-thecal (*Hymenodictyon*), 2-celled, in outline generally narrowly oblong, linear (i.e., narrowly fusiform), narrowly lanceolate, or narrowly elliptic, at base occasionally bifid (i.e., sagittate; *Caelospermum*, *Cephalanthus*, *Duperrea*, *Hamelia*, *Neohymenopogon*, *Scyphiphora*), dorsifixed (i.e., medifixed to dorsifixed near base) to occasionally basifixed, infrequently pubescent (*Hyptianthera*, *Lerchea*), with dehiscence introrse by longitudinal slits or rarely by apical pores (*Argostemma*), with connective infrequently prolonged into an apical and/or sometimes basal appendage (*Acranthera*, *Argostemma*, *Hyptianthera*, *Morinda*, *Rubovietnamia*, *Wendlandia*), appendages rarely fused into a cone (*Acranthera*); pollen variously 3- or 4(or 5)-colpate and generally subglobose or occasionally 3- or 4-porate, 5-25-colpate and disk-shaped or ellipsoidal, in tetrahedral tetrads and 3- or 4-porate, cylindrical with 2 pores, or inaperturate. Ovary inferior [or rarely secondarily superior], sometimes fused between flowers (*Mitchella*, *Morinda*, *Mouretia*), (1 or)2(-10)-celled (i.e., locular), with ovules 1 or 2 to numerous in each cell (i.e., locule) on basal, axile (i.e., inserted on septum), apical, or infrequently parietal (*Ceriscoides*, *Gardenia*) placentas, in staminate flowers usually with ovary reduced and pistillode composed of structures similar to but smaller than style and stigma, in distylous flowers usually with ovary similarly developed but style and stigma differing in size and position in flower and sometimes stigmas also differing in shape between long-styled and short-styled forms; style 1, terminal on ovary, developed or rarely reduced (*Galium*, *Microphysa*), variously glabrous to pubescent, surrounded at base by well-developed fleshy disk [or this rarely reduced], this disk variously annular, conical, 2-parted, or shallowly lobed, glabrous or rarely pubescent (*Clarkella*, *Mouretia*, *Timonius*); stigmas free or rarely fused to anther connectives (*Acranthera*), 1- or 2(-10)-lobed (i.e., these lobes often equivalent to "stigmas 1 or 2 to 10" of some authors), with whole stigma or lobes variously capitate, linear, spatulate, clavate, lobed, or infrequently mitriform (i.e., shaped like a drinking glass) to cylindrical with recessed attachment (*Canthium*, *Mitragyna*, *Pyrostria*), glabrous or infrequently pubescent (*Clarkella*, *Hyptianthera*), variously included to exserted, with receptive surfaces introrse, apical, or internal. Infructescences generally similar to inflorescences but occasionally with part or all changing color, orientation, shape, and/or other characteristics as the fruit mature. Fruit simple or rarely multiple (i.e., a syncarp; *Mitchella*, *Morinda*, *Nauclea*), variously capsular with dehiscence loculicidal, septicidal, circumscissile (i.e., around equator or middle; *Mitracarpus*), or through an apical beak (i.e., prolonged disk portion, sometimes to give appearance of partially superior ovary; *Hedyotis*, *Neanotis*, *Neohymenopogon*, *Ophiorrhiza*, *Pentas*, *Spiradiclis*) or operculum (i.e., circular lid; *Argostemma*, *Leptodermis*, *Leptomischus*, *Mouretia*, *Pseudopyxis*); or fleshy, small to quite large, and baccate (i.e., with numerous seeds enclosed by fleshy to juicy pulp or endocarp and usually indehiscent); or drupaceous (i.e., with 1 to several seeds enclosed in pyrenes), fleshy to occasionally dry, and indehiscent or infrequently dehiscent releasing pyrenes (*Paederia*, *Serissa*); or schizocarpous (i.e., dry and separating into segments) with mericarps (i.e., segments, cocci, nutlets) indehiscent (e.g., *Asperula*, *Cephalanthus*, *Richardia*); calyx limb persistent or deciduous usually leaving a circular scar, sometimes with persistent carpophore or septum (*Adina*); pyrenes (i.e., seeds enclosed in and dispersing with endocarp layer) when present and

ovules all developed 1–10-locular and 1–10-seeded (i.e., fruit containing several pyrenes and each pyrene with 1 seed in 1 locule, or pyrenes solitary in each fruit and comprising entire ovary), ellipsoid to subglobose, plano-convex (i.e., hemispherical), concavo-convex, lenticular, or angled (i.e., narrow with 2 large inner faces and a small outer face), with outer wall hard to cartilaginous (*Caelospermum*) or infrequently papery (*Coffea*, *Pavetta*), smooth to ridged or sulcate on dorsal (i.e., abaxial) surface, without (*Psychotria*) or usually with evident preformed germination slits, pores, and/or opercula generally on ventral (i.e., adaxial) surface, rarely winged (*Paederia*) or pubescent (*Caelospermum*, *Paederia*); seeds 1 to numerous, small (0.1–1.9 mm), medium-sized (2–5 mm) to large (5.1–20 mm), variously ellipsoid, lenticular, flattened, oblanceoloid, angled, or plano-convex, smooth to variously winged, foveolate, tuberculate, papillose, and/or striate; endosperm (i.e., albumen) fleshy, oily, corneous (i.e., horny) and entire or infrequently ruminant (*Psychotria*), or rarely absent (*Antirhea*); embryo variously shaped.  $x = 6–17$ , most commonly 11, less frequently 9 or 12.

About 660 genera and 11,150 species: cosmopolitan family, with most genera and species in humid tropical regions; 97 genera (three endemic, ten introduced) and 701 species (352 endemic, 23 introduced, six of unconfirmed occurrence) in China.

This is one of the largest families of flowering plants and is represented nearly worldwide though it is most abundant in the tropical regions of both hemispheres. Important economic members of the family are coffee (*Coffea*), quinine (*Cinchona*), madder (*Rubia*), ipecac (*Carapichea* Aublet), and various horticultural plants, notably *Gardenia*, *Ixora*, *Mussaenda*, and *Pentas*. Several genera include pantropical weeds, notably *Mitracarpus*, *Richardia*, and *Spermacoce*, of neotropical origin, and *Oldenlandia* (*Hedyotis*) of African origin. A number of species are used for various medicinal purposes.

Genera, tribes, and subfamilies of Rubiaceae characteristically either have or lack raphides; this character is generally considered informative taxonomically in this family. Raphides are tiny, needle-shaped crystals that are produced in groups inside some cells of leaf, stem, flower, and fruit tissues. They apparently function to protect the plant from herbivores. Raphides are often visible with a hand lens on dried specimens, particularly in soft tissues such as petals, the calyx hypanthium, and the young leaves at the apex of the stem, but may be difficult to see especially in succulent plants.

Leaf domatia are common in Rubiaceae and are sometimes taxonomically informative at least for separation of species. These domatia provide protection for tiny mites that live on the leaves and that help protect the plant from herbivores and fungi by eating insect eggs, small insects, and spores. These domatia occasionally take the form of foveolae or crypts, but more often are formed by small groups or tufts of pubescence, which is sometimes different in form from pubescence found on other parts of the plant.

At least half of the species of Rubiaceae have distylous flowers: an individual species has two flower forms, the long-styled form (or pin) with the stigmas borne above the anthers and the short-styled form (or thrum) with the anthers borne above the stigmas. An individual plant bears only one flower form, and the flowers are incompatible with other flowers of similar form whether borne on the same or another plant. Heterostyly is unusual in the flowering plants and is found in several other plant families that mostly have three floral forms instead of two with the third form (the homostylous) with the stigmas and anthers borne at the same level. Tristyly has only been documented very rarely for Rubiaceae, although it was noted by FRPS for *Chassalia curviflora* in China.

A number of species of many genera of Rubiaceae have calyx lobes that are unequal in size on an individual flower, and in some species of several genera one or more of the calyx lobes are markedly different, much enlarged and also often petaloid. These structures are found on flowers, where they are typically brightly colored and apparently function to attract pollinators, and/or on the fruit, where they are dry and brown and apparently function in dispersal of the fruit or seeds. These structures have variously been called “petaloid calyx lobes,” a morphologically descriptive term; “semaphylls,” a term that refers to the assumed function in pollination; and “calycophylls,” the term used here that refers to the leaflike shape of the calyx lobe. These structures are sometimes mistaken for bracts; a few species of Rubiaceae do also have petaloid bracts (e.g., *Dunnia*), but those structures are inserted on the inflorescence axes or immediately below the ovary of the flower.

The woody Rubiaceae are better represented (i.e., more diverse) in moist temperate regions of China than in comparable habitats in North America, as detailed by Latham and Ricklefs (in Ricklefs & Schluter, Spec. Diversity Ecol. Communities, 294–314. 1993). They concluded that this pattern, which is also found in a number of other dicotyledonous families, is due largely to historical factors. The principal factors they identified are the extinction of woody Rubiaceae in these other regions, while the plants were able to persist in E Asia (e.g., *Emmenopterys*), and the long-term direct connection of the moist temperate and moist tropical zones in E Asia vs. the separation of these zones by deserts and large water bodies in other regions. They agreed with Wolfe (in Nelson & Rosen, Vicariance Biogeogr. 413–427. 1981) that the connections of plant ranges between E North America and E Asia were broken by the end of the Eocene, and thus that species of the several genera that are found in both regions (e.g., *Cephalanthus*) have had separate evolutionary histories for some time. Several SE Asian Rubiaceae genera, all found in China, appear to represent the most basal living lineages of the family, notably *Acranthera*, *Coptosapelta*, and *Luculia* (Bremer et al., Syst. Biol. 48: 413–435. 1999; Bremer & Manen, Pl. Syst. Evol. 225: 43–72. 2000; Rydin et al., Pl. Syst. Evol. 278: 101–123. 2009).

A number of species of Rubiaceae are cultivated as ornamentals; most of these are mentioned and some are keyed and described here.

Additional information on many of the cultivated Rubiaceae was presented by Puff and Chamchumroon (Thai Forest Bull., Bot. 31: 75–94. 2003).

Complete Rubiaceae floras for E Asia are very few. The Chinese Rubiaceae were treated comprehensively in 1999 by FRPS; the treatment here is based primarily on that work. The Fl. URSS was published in English in 2000, but this is an unedited, unmodified translation of the 1958 work. The Fl. Japan has been published in several editions but includes relatively few genera and is rather idiosyncratic. The genus overview within the Rubiaceae of Thailand: A Pictorial Guide to Indigenous and Cultivated Genera by Puff et al. (43–240. 2005) is a useful recent reference.

Some morphological features that are characteristic of the Rubiaceae have been described, measured, and named very differently by different authors, and the differing terminology has generated some confusion. In particular, the terminology and measurements used for the calyx and gynoecium have differed widely. The ovary of Rubiaceae flowers is typically inferior, and the calyx is gamosepalous with its free portion, or limb, arising from the top of the ovary portion; this limb varies from reduced (i.e., not developed) to developed, and truncate to deeply lobed. Most Rubiaceae authors have distinguished the inferior ovary portion of the flower from the free calyx limb; the ovary portion has sometimes been called

simply an ovary, but sometimes considered to include the fused calyx and corolla tissue covering it and called a hypanthium. However, several authors, including in FRPS, have treated as one structure the inferior ovary together with the unlobed lower portion of the calyx limb, when this is present, as the “calyx tube” and the lobed portion of the calyx as a separate structure, the calyx lobes. The “calyx tube” is often clearly delimited and measurable, but the inclusion of the ovary in this means that this measurement can sometimes include ovaries that have been fertilized and are developing into fruit, thus are larger than and not comparable to the ovaries at anthesis even though the corolla may be still attached to the flowers. Here the ovary or hypanthium portion of the flower is measured separately from the limb; the term “hypanthium” is used to link these measurements to those of FRPS. The limb is measured separately here because the length of the tubular portion of this often includes taxonomically useful information, and while the “calyx tube” measurement is lost when the fruit are developed, the length of the tubular portion of the free calyx limb is usually still evident on the fruit thus facilitating identification. Another portion of the gynoecium that has been regarded differently by different authors is the distinction between the stigma and style: the structures regarded as 2-lobed stigmas by some authors are regarded as a style with 2 separate stigmas by as many other authors. Morphological study of the androecium and gynoecium here during preparation of a flora treatment has not been detailed and no focused effort has been made here to systematize these morphological interpretations.

Inflorescence terminology is complicated in most flowering plant families. The terms “bract” and “bracteole” have been carefully and regularly applied by some Rubiaceae authors, with the term “bracteole” used only for the bracts that immediately subtend the flowers or in some cases that are found anywhere along the pedicels, and the term “bract” used for the remaining structures. However, other authors have not distinguished these structures, or have not distinguished them regularly or consistently. The term “floral bract” here refers to the structures found on the pedicels or that immediately subtend sessile flowers. Bracts and leaves are generally considered homologous structures, and in Rubiaceae these often vary continuously along the inflorescences. In particular, Rubiaceae commonly have somewhat reduced leaves subtending the inflorescences, and bracts that are somewhat enlarged and occasionally leaflike. These structures have been variously called “reduced leaves” or “foliose bracts” or “foliaceous bracts” (here called “leaflike bracts”). In particular, many species with branched inflorescences sometimes have rather large, leaflike bracts subtending the basalmost pair of secondary axes; these have been variously interpreted as enlarged bracts at the top of the peduncle, or vegetative leaves that are borne at the base of a sessile, tripartite inflorescence.

Significant measurements found on plants from outside China are noted in the discussions following the species descriptions and/or are included within brackets in the descriptions in accordance with *Flora of China* style. Authors in FRPS described the seeds and embryos of some Rubiaceae but not others; their descriptions are reported. In many cases no information is available about these features for Chinese Rubiaceae. Authors in FRPS also described the pollen of a few genera; these reports are not included here because a number of very detailed, extensively documented pollen descriptions are available elsewhere, which show that much variation is found in pollen morphology at the species level in Rubiaceae and as yet Rubiaceae genera are not well characterized in terms of pollen. Thus, the very limited information available only at the genus level here does not seem well integrated into this flora treatment. The counts presented here for leaf veins apply to the secondary veins, as done by the majority of Rubiaceae authors. Many species of Rubiaceae also frequently have rather well-developed though shorter intersecondary veins, which often vary widely in number and degree of development between populations or plants; these apparently were occasionally combined with the secondary veins in the measurements given by FRPS, but such measurements are subject to significant misinterpretation by authors working in other regions and the varied usage in that work adds yet more confusion.

Where data were missing from the descriptions in the first draft for the *Flora of China*, the terms “unknown,” “not known,” “not noted,” and “not seen” were retained (with “not known” consisted to “unknown”). Where these terms were used in the habitats and elevational ranges they were deleted in accordance with the style of previous *Flora of China* volumes. Where missing data were denoted with question marks, e.g., “shape??,” or with constructions such as “\_\_ × \_\_,” these were deleted because it was not apparent which of the above categories of missing data applied.

The genus *Khasiaclumea* Ridsdale (Blumea 24: 347. 1979) is known with certainty from India and Myanmar and provisionally from N Vietnam; this may also be present in China, but no confidently determined specimens have yet been seen. The single species, *K. oligocephala* (Haviland) Ridsdale (Blumea 24: 347. 1979; *Adina oligocephala* Haviland, J. Linn. Soc., Bot. 33: 46. 1897), was reported by Ridsdale (loc. cit.) as “probably” found in China; however, this genus is not treated here.

Lo Hsienshui, Ko Wancheung, Chen Weichiu, Hsue Hsianghao & Wu Hen. 1999. Rubiaceae (1). *In*: Chen Weichiu, ed., Fl. Reipubl. Popularis Sin. 71(1): i–xvii, 1–432; Lo Hsienshui, Ko Wancheung, Chen Weichiu & Ruan Yunzhen. 1999. Rubiaceae: Rubioideae. *In*: Chen Weichiu, ed., Fl. Reipubl. Popularis Sin. 71(2): i–xvi, 1–377; Wan Wenhao. 2000. Theligonaceae. *In*: Chen Chia-jui, ed., Fl. Reipubl. Popularis Sin. 52(2): 147–151.

### Key 1

- 1a. Leaves apparently whorled and estipulate, 4 to numerous at each node; herbs, twiners, and low shrubs; calyx limb reduced to a thin rim or absent ..... Key 2
- 1b. Leaves paired to whorled with stipules developed between each pair; calyx limb well developed to reduced or apparently absent.
  - 2a. Acaulescent to caulescent herbs, soft subshrubs, or herbaceous vines or clambering plants, if tall subshrubs then stems annual ..... Key 3
  - 2b. Low to tall woody shrubs, trees, or lianas with well-developed secondary growth and perennial stems ..... Key 4

### Key 2

- 1a. Flowers 5-merous and fruit fleshy, dispersing as 1 drupaceous structure, red to orange or black ..... 79. *Rubia*
- 1b. Flowers 4-merous or 5-merous, fruit dry though sometimes inflated, dispersing as 1 structure or splitting into 2 structures.
  - 2a. Fruit inflated, dispersing as 1 structure; flowers 4-merous ..... 50. *Microphysa*
  - 2b. Fruit not inflated, schizocarpous and dispersing as 2 partially to completely separated mericarps; flowers 4- or 5-merous.
    - 3a. Corollas rotate to campanulate or broadly funnellform ..... 28. *Galium*
    - 3b. Corollas tubular to salverform or funnellform.

- 4a. Corollas 5-merous ..... 70. *Phuopsis*  
 4b. Corollas 4-merous (in our species).  
     5a. Leaves narrowly elliptic to lanceolate, with developed blades; mericarps ellipsoid and generally straight ..... 7. *Asperula*  
     5b. Leaves linear, with blades hardly developed; mericarps obovoid and markedly curved ..... 46. *Leptunis*

**Key 3**

- 1a. Flowers fused in pairs by their ovaries; fruit fused in pairs ..... 51. *Mitchella*  
 1b. Flowers and fruit free.  
     2a. Plants monoecious, with unisexual anemophilous flowers, staminate with 3 or 5 corolla lobes, 6–30 stamens, and no ovary, pistillate with 3 corolla lobes, reduced staminodes, and a 1-celled ovary; calyx limb reduced to absent ..... 91. *Theligonum*  
     2b. Plants with bisexual insect-pollinated flowers, with 4–6 corolla lobes, with 4–6 stamens, and 2–5-celled ovary both developed; calyx limb well developed to reduced or absent.  
       3a. Calyx limb reduced to a thin truncate rim or absent.  
         4a. Flowers 5-merous and fruit fleshy, orange to red or black ..... 79. *Rubia*  
         4b. Flowers 4- or 5-merous and fruit dry, schizocarpous or capsular, green to brown.  
           5a. Ovules numerous in each cell; fruit capsular, mitriform and laterally markedly flattened (this shape often evident in young developing fruit), with numerous small seeds ..... 65. *Ophiorrhiza*  
           5b. Ovules 1 per cell; fruit indehiscent or schizocarpous with 2 mericarps, ellipsoid to subglobose, sometimes flattened, with 2 seeds.  
             6a. Fruit inflated, dispersing as a single structure ..... 50. *Microphysa*  
             6b. Fruit not inflated, schizocarpous, dispersing as 2 partially to completely separated mericarps.  
               7a. Corolla salverform to tubular or funnellform ..... 7. *Asperula*  
               7b. Corolla rotate to campanulate or broadly funnellform ..... 28. *Galium*  
       3b. Calyx limb developed, with lobes sometimes reduced but still evident.  
         8a. Ovary and fruit densely covered by well-developed, unusual, flattened or curved and glandular trichomes or projections.  
         9a. Ovary and fruit covered with flattened trichomes, these sometimes with apical thickenings; flowers solitary, terminal or pseudoaxillary, sessile or subsessile ..... 21. *Dentella*  
         9b. Ovary and fruit covered with glandular curved trichomes; flowers several and pedicellate in terminal and pseudoaxillary, irregularly branched cymes ..... 41. *Kelloggia*  
         8b. Ovary and fruit smooth and glabrous to variously pubescent but trichomes neither regularly glandular nor markedly flattened.  
           10a. Plants extensively twining, climbing, or clambering, with stems slender and herbaceous or suffrutescent and flexuous.  
             11a. Plants climbing by adventitious roots (*P. serpens*); stipules deciduous after distalmost few nodes; fruit fleshy, drupaceous, red ..... 74. *Psychotria*  
             11b. Plants not climbing by adventitious roots, these sometimes scattered along stem but not principal supports; stipules persistent or deciduous; fruit dry, green or becoming brown or black.  
               12a. Plants not fetid when bruised; fruit capsular with several to numerous small angled seeds; corollas with 4 or 5 valvate lobes ..... 35. *Hedyotis*  
               12b. Plants usually with fetid odor when bruised; fruit schizocarpous, dry, inflated, with 2 flattened winged pyrenes; corollas with 4–6 valvate-induplicate lobes ..... 66. *Paederia*  
           10b. Plants weak to erect, creeping on ground, self-supporting or weakly shortly clambering.  
             13a. Cultivated plants; corolla white to pink or red, 20–25 mm; fruit usually not developing ..... 68. *Pentas*  
             13b. Wild plants; corolla white to red or purple, 1–55 mm; fruit usually developing.  
               14a. Stipules setose, lacinate, multifid, fimbriate, and/or dentate to markedly erose, if lobed then lobes 4 or more and entire or erose.  
               15a. Calyx and corolla lobes each 6; fruit schizocarpous with 3 mericarps ..... 76. *Richardia*  
               15b. Calyx and corolla lobes 3–5; fruit indehiscent, schizocarpous with 2 mericarps, or capsular.  
               16a. Flowers solitary and sessile, or several and sessile in sessile heads or glomerules.  
               17a. Fruit a circumscissile capsule; calyx lobes usually with hyaline margins; seeds 2 with cruciform attachment scar ..... 52. *Mitracarpus*  
               17b. Fruit indehiscent, schizocarpous, or capsular and splitting longitudinally or apically; calyx lobes with margins not hyaline; seeds 2 to numerous with simple rounded to linear attachment scar.  
               18a. Seeds 1 per cell, 2 per fruit, fruit indehiscent, schizocarpous splitting into mericarps, or capsular splitting longitudinally and deeply.  
               19a. Fruit indehiscent or splitting into 2 indehiscent mericarps ..... 22. *Diodia*

- 19b. Fruit capsular, splitting septicidally into 2 segments with 1 or both segments then splitting loculicidally ..... 86. *Spermacoce*
- 18b. Seeds 2 or more per cell, 4 or more per fruit, fruit indehiscent, schizocarpous splitting into mericarps, or capsular splitting primarily through apical beak or apical half.
- 20a. Plants without fetid odor when bruised, usually drying green or brownish green; seeds angled to lenticular ..... 35. *Hedyotis*
- 20b. Plants usually with fetid odor when bruised, usually drying black to gray; seeds peltate to plano-convex ..... 60. *Neanotis*
- 16b. Flowers solitary to numerous, sessile to pedicellate or pedunculate in fascicles or cymes, if flowers sessile then borne severally in cymes or in pedunculate heads or glomerules.
- 21a. Fruit schizocarpous, flattened, with 2 suborbicular indehiscent mericarps ..... 42. *Knoxia*
- 21b. Fruit capsular, subglobose to ovoid or mitriform, opening to release several to numerous seeds.
- 22a. Fruit mitriform and laterally markedly flattened (this shape often evident in young developing fruit) ..... 65. *Ophiorrhiza*
- 22b. Fruit subglobose to ovoid, angled to ridged but strongly flattened laterally.
- 23a. Fruit opening through apical lid that develops from disk ..... 73. *Pseudopyxis*
- 23b. Fruit dehiscent through linear openings across top and often extending down sides.
- 24a. Flowers 5-merous ..... 88. *Spiradiclis*
- 24b. Flowers 4- or 5-merous.
- 25a. Plants without fetid odor when bruised, usually drying green or brownish green; seeds angled to lenticular ..... 35. *Hedyotis*
- 25b. Plants usually with fetid odor when bruised, usually drying black to gray; seeds peltate to plano-convex ..... 60. *Neanotis*
- 14b. Stipules entire, 2-lobed, or 3-lobed, lobes entire.
- 26a. Fruit a fleshy drupe with 2–4 pyrenes; principal stems creeping, with short erect reproductive stems.
- 27a. Inflorescences several flowered, capitate, and pedunculate; leaves cordiform to ovate ..... 30. *Geophila*
- 27b. Flowers solitary, sessile or subsessile; leaves elliptic ..... 64. *Nertera*
- 26b. Fruit dry, or fleshy and baccate with several to numerous seeds; habit erect to creeping with or without short erect reproductive stems.
- 28a. Stipules densely covered with numerous, closely set, parallel or palmate fibers or veins ..... 58. *Myrioneuron*
- 28b. Stipules smooth, without evident veins or fibers or 1- or 2-costate.
- 29a. Fruit dry and indehiscent or schizocarpous.
- 30a. Fruit indehiscent, obconical, several seeded; small herbs with well-developed tubers ..... 17. *Clarkella*
- 30b. Fruit schizocarpous with 2 flattened, suborbicular mericarps; erect to rather tall herbs without tubers ..... 42. *Knoxia*
- 29b. Fruit dry and capsular, or fleshy and indehiscent.
- 31a. Fruit mitriform and laterally markedly flattened (this shape often evident in young developing fruit) ..... 65. *Ophiorrhiza*
- 31b. Fruit subglobose to ovoid, laterally not or only weakly flattened.
- 32a. Fruit an operculate capsule (dehiscence mode unknown in *Keenania*).
- 33a. Flowers 1 to several in cymes or fascicles, all of them generally well separated by each other on inflorescence axes and/or pedicels.
- 34a. Corolla rotate to campanulate; ovary and fruit 2-celled ..... 6. *Argostemma*
- 34b. Corolla tubular-funnelform to salverform; ovary and fruit 4- or 5-celled ..... 73. *Pseudopyxis*
- 33b. Flowers several to numerous in heads or congested cymes, many or all of them closely grouped together.
- 35a. Ovules and seeds borne on stipitate placentas near base of septum ..... 45. *Leptomischus*
- 35b. Ovules and seeds borne on peltate placentas near middle of septum.
- 36a. Plants apparently without raphides; disk apparently glabrous ..... 40. *Keenania*
- 36b. Raphides present; disk puberulent ..... 55. *Mouretia*
- 32b. Fruit a capsule dehiscent through linear openings, or fleshy and indehiscent.
- 37a. Ovary and fruit 5-celled; plants often with fetid odor when bruised ..... 87. *Spermadictyon*
- 37b. Ovary and fruit 1- or 2-celled; plants without or sometimes with fetid odor when bruised.
- 38a. Fruit baccate, fleshy to dry, indehiscent (unknown in *Keenania*).
- 39a. Flowers solitary on paired axillary short shoots (i.e., brachyblasts); corollas ca. 55 mm ..... 1. *Acranthera*
- 39b. Flowers 2 to numerous on axillary or terminal peduncles; corollas 3–10 mm.

- 40a. Corolla lobes convolute in bud; plants nearly to completely acaulescent ..... 32. *Guihaiothamnus*  
 40b. Corolla lobes valvate in bud; plants with stems (so far as known).  
 41a. Inflorescences cymose, branched; raphides present and evident ..... 47. *Lerchea*  
 41b. Inflorescences capitate or congested-cymose, not or sparingly branched;  
 plants perhaps with raphides but these not readily evident ..... 40. *Keenania*  
 38b. Fruit capsular, septicidal or loculicidal (unknown in *Keenania*).  
 42a. Flowers with 4 calyx and corolla lobes and stamens or some flowers occasionally  
 with 5.  
 43a. Plants without fetid odor when bruised, usually drying green or brownish green;  
 seeds angled to lenticular ..... 35. *Hedyotis*  
 43b. Plants usually with fetid odor when bruised, usually drying black to gray; seeds  
 peltate to plano-convex ..... 60. *Neanotis*  
 42b. Flowers with 5 calyx and corolla lobes and stamens.  
 44a. Inflorescences capitate or congested-cymose; ovary and fruit smooth ..... 40. *Keenania*  
 44b. Inflorescences branched, cymose; ovary and fruit ridged to winged ..... 88. *Spiradiclis*

**Key 4**

- 1a. Leaves with tertiary or quaternary venation finely, regularly lineolate (this visible best on abaxial surface);  
 inflorescences axillary; fruit a fleshy drupe.  
 2a. Fruit with 1 pyrene, this with 2–5 cells (and seeds); corollas 5–11 mm, with 4 or 5 lobes ..... 5. *Antirhea*  
 2b. Fruit with 50 or more pyrenes, each with 1 cell; corollas 10–15 mm, with 6 lobes ..... 92. *Timonius*  
 1b. Leaves with tertiary and higher order venation not visible or irregularly to somewhat regularly areolate;  
 inflorescences axillary, terminal, or in other positions; fruit dry to fleshy, drupaceous, baccate, capsular,  
 schizocarpous, or other form.  
 3a. Plants mangroves, growing along seashores in areas regularly inundated by saltwater, with succulent tissues,  
 usually with stilt roots, usually with young growth covered with mucilage or resin ..... 83. *Scyphiphora*  
 3b. Plants of terrestrial or freshwater riverine habitats, with succulent to very thin tissues, without stilt roots,  
 with young growth covered with resin or not.  
 4a. Flowers fused together by their ovaries, at least shortly at their bases; fruit multiple (i.e., formed from  
 more than 1 flower).  
 5a. Stipules twisted or imbricate in a hemispherical to conical bud; fruit drupaceous, each with 2 or 4 pyrenes,  
 each pyrene with 1 seed ..... 54. *Morinda*  
 5b. Stipules held erect and pressed together in flattened bud; fruit baccate, each fruit with numerous seeds ..... 59. *Nauclea*  
 4b. Flowers free, sometimes tightly packed on a common supporting structure but not actually fused; fruit  
 free (i.e., each formed from only 1 flower).  
 6a. Flowers in 1 to several symmetrical, globose heads, heads sessile to pedunculate, terminal or axillary,  
 flowers sessile to pedicellate.  
 7a. Lianas with recurved spines ..... 94. *Uncaria*  
 7b. Shrubs or trees, unarmed.  
 8a. Some or all leaves truncate to cordate at base.  
 9a. Inflorescences all axillary; stipules ovate to elliptic or spatulate, unlobed, held erect and pressed  
 together in a flattened bud ..... 33. *Haldina*  
 9b. Inflorescences terminal and sometimes also in uppermost leaf axils; stipules ovate in outline and  
 deeply bilobed, imbricate in a conical bud ..... 85. *Sinoadina*  
 8b. Leaves obtuse to acute at base.  
 10a. Fruit indehiscent; large trees, frequently cultivated for lumber ..... 62. *Neolamarckia*  
 10b. Fruit schizocarpous splitting into 2 mericarps or capsular with septicidal then loculicidal  
 dehiscence; shrubs and trees, perhaps occasionally cultivated.  
 11a. Fruit schizocarpous, splitting into 2 indehiscent mericarps; leaves opposite or whorled;  
 shrubs ..... 13. *Cephalanthus*  
 11b. Fruit capsular, valves opening to release seeds; leaves opposite; shrubs and trees.  
 12a. Stipules held erect and pressed together in a flattened bud.  
 13a. Inflorescence heads sessile or subsessile with peduncles up to 0.5 cm; stigmas cylindrical  
 with style attached in a recessed portion (i.e., upside-down mitriform) ..... 53. *Mitragyna*  
 13b. Inflorescence heads pedunculate, peduncles 1–8 cm; stigmas globose to ovoid ..... 63. *Neonauclea*  
 12b. Stipules imbricate or valvate in a conical to hemispherical bud.  
 14a. Seeds subglobose to trigonous or ellipsoid, not winged ..... 49. *Metadina*  
 14b. Seeds flattened to fusiform or angled, usually winged.  
 15a. Calyx lobes ca. 0.5 mm; fruit 5–7 mm ..... 85. *Sinoadina*

- 15b. Calyx lobes 1–2 mm; fruit 1.5–5 mm.
- 16a. Stipules deeply bilobed for more than 1/2 their length ..... 2. *Adina*
- 16b. Stipules triangular and entire to shortly bilobed for 1/4 or less their length ..... 69. *Pertusadina*
- 6b. Flowers variously arranged in heads, cymes, panicles, or other types of groups, these groups sometimes umbelliform but heads then not symmetrically globose, terminal, axillary, pseudoaxillary, or in other positions.
- 17a. Fruit capsular, opening through an apical operculum and later sometimes splitting into 5 valves, with each seed individually enclosed in a fibrous, netlike aril ..... 44. *Leptodermis*
- 17b. Fruit indehiscent, baccate, drupaceous, or capsular but then not operculate and with fewer than 5 valves, seeds without aril or with aril continuous, fleshy.
- 18a. Inflorescences not borne at stem apex but regularly axillary (i.e., borne in both axils at a node), superaxillary, and/or apparently axillary due to regularly produced axillary or lateral short shoots (i.e., brachyblasts).
- 19a. Stems and abaxial surface of leaf densely sericeous, hirsute, or strigose with remarkably long silky trichomes ..... 97. *Xanthophyllum*
- 19b. Stems and abaxial surface of leaf variously glabrous to pubescent with trichomes of various types, but not densely and consistently long and silky.
- 20a. Inflorescence borne on regular paired axillary short shoots (i.e., brachyblasts), each short shoot with several stipulate nodes; fruit fleshy and drupaceous or baccate, or dry and indehiscent or schizocarpous.
- 21a. Stipules with 1–8 stiffly spiniform bristles ..... 84. *Serissa*
- 21b. Stipules entire or with several to numerous bristles or projections but these not spiny.
- 22a. Bracts multifid with segments glandular.
- 23a. Corolla lobes valvate in bud; fruit a fleshy drupe ..... 20. *Damnacanthus*
- 23b. Corolla lobes convolute in bud; fruit a dry schizocarp ..... 93. *Trailliaedoxa*
- 22b. Bracts absent or entire and not glandular.
- 24a. Stipules bilobed ..... 72. *Prismatomeris*
- 24b. Stipules triangular.
- 25a. Flowers with 4 calyx lobes, corolla lobes, and stamens.
- 26a. Petioles and inflorescence axes articulate at their bases; stigmas fusiform ..... 39. *Ixora*
- 26b. Petioles and inflorescence axes not articulate; stipules lobed.
- 27a. Plants without fetid odor; corolla salverform, with lobes convolute in bud ..... 67. *Pavetta*
- 27b. Plants with or without fetid odor when bruised; corolla campanulate, tubular, or funnelform, with lobes valvate or valvate-induplicate in bud ..... 81. *Saprosma*
- 25b. Flowers with 5 calyx lobes, corolla lobes, and stamens.
- 28a. Calyx lobes 5–8 mm ..... 12. *Catunaregam*
- 28b. Calyx lobes 0.5–4 mm.
- 29a. Ovules and seeds 1–4 in each cell; plants without spines; flowers sessile and solitary ..... 36. *Himalrandia*
- 29b. Ovules and seeds more than 4 in each cell; plants with or without spines; flowers sessile to pedicellate, solitary to several in fascicles.
- 30a. Plants with bisexual flowers; ovary with ovules and seeds attached to septum (i.e., axile) ..... 8. *Benkara*
- 30b. Plants dioecious; ovary with ovules and seeds attached to outer wall (i.e., parietal); nodes of stems mostly reduced ..... 14. *Ceriscoides*
- 20b. Inflorescences borne on peduncles directly from main stems, these with no more than 1 reduced basal node.
- 31a. Inflorescences racemiform or spiciform, with well-developed primary axes directly bearing numerous pedicels ..... 37. *Hymenodictyon*
- 31b. Inflorescences capitate to cymose, without well-developed primary axes or with axes of several orders developed, with higher order axes or all axes bearing few to numerous pedicels.
- 32a. Woody twiners or climbers; fruit a woody capsule, subglobose, with winged seeds ..... 19. *Coptosapelta*
- 32b. Erect shrubs and trees; fruit fleshy and indehiscent or capsular, papery to cartilaginous, flattened, with unwinged seeds.
- 33a. Fruit capsular, papery to cartilaginous, mitriform and laterally markedly flattened (this shape often evident in young developing fruit) ..... 65. *Ophiorrhiza*
- 33b. Fruit indehiscent and fleshy.

- 34a. Corolla lobes imbricate in bud; fruit a drupe with a single, 4–9-celled subglobose pyrene, this 2–3 cm in diam.; plants of coastal thickets ..... 31. *Guettarda*
- 34b. Corolla lobes convolute or valvate in bud or imbricate in some species of *Lasianthus*; fruit baccate with numerous seeds or drupaceous with 1-celled pyrenes 2 to numerous; plants of interior habitats.
- 35a. Cultivated plants; corolla lobes convolute in bud; fruit drupaceous with 2 plano-convex pyrenes with papery walls; bracts fused in calyculate pairs ..... 18. *Coffea*
- 35b. Native plants; corolla lobes convolute, valvate, or imbricate in bud; fruit baccate or drupaceous with 2 to numerous plano-convex to angled, ellipsoid-oblong, ellipsoid, or flattened, hard-walled pyrenes; bracts free or fused in calyculate pairs.
- 36a. Fruit a berry with several to numerous seeds.
- 37a. Seeds numerous; corolla lobes valvate in bud ..... 95. *Urophyllum*
- 37b. Seeds 3–8; corolla lobes convolute in bud.
- 38a. Ovules and seeds 1–3 per cell; stigmas papillose; calyx lobes minute or up to 0.5 mm ..... 23. *Diplospora*
- 38b. Ovules and seeds 3–6 per cell; stigmas pubescent; calyx lobes 1–2 mm ..... 38. *Hyptianthera*
- 36b. Fruit a drupe, with 2 to numerous pyrenes, each containing 1 seed.
- 39a. Flower buds acute to rounded at apex; pyrenes flattened to triangular; plants often with fetid odor when bruised ..... 43. *Lasianthus*
- 39b. Flower buds sharply acute to acuminate at apex; pyrenes plano-convex to ellipsoid-oblong or ellipsoid; plants without fetid odor.
- 40a. Plants without or sometimes with spines; stipules pilose to sericeous inside (i.e., adaxially) ..... 11. *Canthium*
- 40b. Plants without spines; stipules glabrous inside ..... 75. *Psydrax*
- 18b. Inflorescences terminal, pseudoaxillary (i.e., regularly borne in only 1 axil at a node), or apparently pseudoaxillary or lateral due to anisophylly or an undeveloped internode.
- 41a. Stipules with 1–8 sharp spines or spiny bristles ..... 84. *Serissa*
- 41b. Stipules entire to lobed or multifid, sometimes aristate or caudate but not spiny.
- 42a. Stipules with several well-developed, fibrous, closely set veins, these parallel to palmate ..... 58. *Myrioneuron*
- 42b. Stipules smooth, 1–3-costate but not densely veined.
- 43a. Calyx limb with developed truncate tube; flowers several to numerous, all pedicellate, borne in umbelliform cymules ..... 10. *Caelospermum*
- 43b. Calyx limb reduced to developed and at least shortly lobed or denticulate; flowers variously arranged but not uniformly pedicellate in umbelliform cymules.
- 44a. Corolla lobes convolute in bud and fruit a berry with fleshy to leathery outer wall.
- 45a. Fruit and usually ovary portion of calyx 5–8-ridged or -winged, ridges continuous with midrib of each calyx lobe ..... 29. *Gardenia*
- 45b. Fruit and ovary portion of calyx smooth to tuberculate.
- 46a. Some or all inflorescences regularly borne in pseudoaxillary, leaf-opposed, and/or lateral position with only 1 inflorescence per node (i.e., not paired, borne on only one side of stem), this arrangement due to anisophylly or a reduced internode producing apparently alternate leaves or a 3-leaved node.
- 47a. Inflorescences all apparently leaf-opposed or borne at leafless nodes (due to extreme anisophylly), stems with paired or apparently alternate leaves ..... 3. *Aidia*
- 47b. Inflorescences mostly borne on apparently 3-leaved nodes, stems with some 3-leaved nodes.
- 48a. Flowers 12 or more per inflorescence ..... 25. *Duperrea*
- 48b. Flowers 1–10 per inflorescence.
- 49a. Some or all leaf apices with short filamentous arista or projection ..... 80. *Rubovietnamia*
- 49b. Leaf apices without filamentous projections.
- 50a. Plants dioecious, with unisexual flowers; fruit 5–15 mm in diam.; corollas (so far as known) 5–8 mm ..... 9. *Brachytome*
- 50b. Plants with bisexual flowers; fruit ca. 35 mm in diam.; corollas 68–75 mm ..... 78. *Rothmannia*
- 46b. Inflorescence borne at stem apices and sometimes in adjacent uppermost leaf axils, sometimes displaced to pseudoaxillary by subsequent overtopping stem growth, produced at stems generally with number and arrangement of leaves similar at all nodes.
- 51a. Low shrubs, up to 0.5 m tall, with many internodes reduced and relatively small leaves.

- 52a. Flowers solitary ..... 36. *Himalrandia*  
 52b. Flowers in cymes of 6–12 ..... 93. *Trailliaedoxa*
- 51b. Shrubs, low (ca. 0.3 m tall) to tall, or trees.
- 53a. Corolla densely sericeous (i.e., with long, silky, appressed trichomes) on outside .... 71. *Porterandia*  
 53b. Corolla glabrous to puberulent, spreading pubescent, or strigillose (i.e., with short appressed trichomes) on outside.
- 54a. Inflorescences with 1–7 flowers; fruit 4–11 cm ..... 27. *Fosbergia*  
 54b. Inflorescences with 5 to numerous flowers; fruit 2 cm or shorter.
- 55a. Petioles and inflorescence axes articulate; ovules and seeds 1 per cell, 2 per ovary or fruit; stigmas unlobed ..... 39. *Ixora*  
 55b. Petioles and inflorescence axes not articulate; ovules and seeds 1 to numerous per cell, 2 to numerous per ovary or fruit; stigmas lobed.
- 56a. Bark of older stems becoming coppery red and circumferentially wrinkled to peeling ..... 90. *Tarennoidea*  
 56b. Bark of older stems smooth, persistent, green to gray or brown, sometimes becoming longitudinally striate or fissured with age.
- 57a. Ovules 1 per cell and 2 per ovary; fruit drupaceous with 2 plano-convex pyrenes ..... 67. *Pavetta*  
 57b. Ovules 2 or more per cell and 4 or more per ovary; fruit baccate with seeds 2 or more, ellipsoid, obovoid, or compressed globose.
- 58a. Seeds 2–6 per fruit, 4–5 mm in diam., compressed globose, fruit yellowish white; plants without spines ..... 4. *Alleizettella*  
 58b. Seeds 4 to numerous per fruit, 3–5 mm in diam., compressed globose to ellipsoid or obovoid, fruit purplish black, black, or sometimes white; plants with or without spines.
- 59a. Plants without or usually with spines; calyx limb persistent or deciduous on fruit ..... 8. *Benkara*  
 59b. Plants without spines; calyx limb deciduous on fruit ..... 89. *Tarenna*
- 44b. Corolla lobes valvate, valvate-induplicate, imbricate, or convolute in bud and fruit a drupe, berry, capsule, or schizocarp, if corolla lobes convolute then fruit not a berry.
- 60a. Stigmas, cells of ovary, and cells of fruit 4 or 5.
- 61a. Corollas tubular with relatively short lobes, these 10% or less of total corolla length; plants cultivated ornamentals ..... 34. *Hamelia*  
 61b. Corollas funnelform, tubular-funnelform, or salverform with lobes developed, 15% or more of total corolla length; plants native or cultivated.
- 62a. Fruit dry, schizocarpous or capsular, leathery; plants often with fetid odor when bruised ..... 87. *Spermadictyon*  
 62b. Fruit fleshy and drupaceous or baccate, or capsular and thinly textured; plants without fetid odor.
- 63a. Plants not particularly succulent, sometimes with spines, usually with some internodes not expanded; calyx without stalked glands ..... 20. *Dammacanthus*  
 63b. Plants sometimes succulent, without spines, with all internodes expanded; calyx sometimes with stalked glands ..... 57. *Mycetia*
- 60b. Stigmas 1 or 2 and cells of ovary and fruit 2, or sometimes any of these 3 on some but not all flowers in an inflorescence.
- 64a. Cultivated ornamental plants; herbs and low shrubs to small trees; corollas red, orange, or yellow.
- 65a. Stigmas unlobed; corolla lobes convolute in bud; petioles and inflorescence axes articulate ..... 39. *Ixora*  
 65b. Stigmas 2- or 3-lobed; corolla lobes valvate, valvate-induplicate, or imbricate in bud; petioles and inflorescence axes not articulate.
- 66a. Plants often with petaloid calycophylls; corolla lobes valvate-induplicate in bud ..... 56. *Mussaenda*  
 66b. Plants without petaloid calycophylls; corolla lobes valvate or imbricate in bud.
- 67a. Herbs and low shrubs; corolla with white pubescence in throat, lobes obtuse to acute, with margins flat ..... 68. *Pentas*  
 67b. Shrubs; corolla with yellow pubescence in throat, lobes broadly obtuse to rounded, with margins flat to crisped ..... 77. *Rondeletia*
- 64b. Native plants; low shrubs to large trees; corollas white, pink, purple, yellow, or red.

- 68a. Fruit indehiscent, drupaceous, or baccate, fleshy or leathery; corolla lobes convolute, imbricate, or valvate in bud; ovules and seeds 1 to numerous per cell, 2 to numerous per fruit.
- 69a. Stigmas unlobed; petioles and inflorescence axes articulate at base ..... 39. *Ixora*
- 69b. Stigmas 2- or 3-lobed; petioles and inflorescence axes not articulate.
- 70a. Fruit baccate, with numerous seeds in each cell, these enclosed in soft tissues.
- 71a. Corolla lobes valvate-reduplicate; calyx sometimes with calycophylls, without stalked glands; seeds flattened; plants not succulent ..... 56. *Mussaenda*
- 71b. Corolla lobes valvate-induplicate; calyx without calycophylls, sometimes with stalked glands; seeds angled; plants often succulent ..... 57. *Mycetia*
- 70b. Fruit indehiscent or drupaceous, with 1 seed in each cell, this enclosed in a pyrene.
- 72a. Stipules caducous or rather quickly deciduous, often exposing a ring of persistent trichomes that usually dry red-brown (use magnification) ..... 74. *Psychotria*
- 72b. Stipules persistent to caducous, not enclosing persistent trichomes or these reduced and/or drying white.
- 73a. Corolla lobes convolute in bud.
- 74a. Fruit drupaceous, with pyrenes flattened to concavo-convex ..... 67. *Pavetta*
- 74b. Fruit schizocarpous with segments or valves oblanceoloid ..... 93. *Trailliaedoxa*
- 73b. Corolla lobes valvate in bud.
- 75a. Corolla tubular-funnelform with base usually gibbous and tube usually curved ..... 15. *Chassalia*
- 75b. Corolla tubular-funnelform or salverform, generally straight at base and in tube.
- 76a. Stipules persistent and becoming hardened and yellowed with age, often fragmenting when older ..... 74. *Psychotria*
- 76b. Stipules caducous, or persistent but then not becoming hardened, yellowed, or fragmented.
- 77a. Plants often with fetid odor when bruised; corolla lobes mostly 4, or on a few flowers of some plants 5 or 6 ..... 81. *Saprosma*
- 77b. Plants without fetid odor; corolla lobes regularly 5, on a few flowers of some plants 4.
- 78a. Bracts glandular-multifid ..... 20. *Damnacanthus*
- 78b. Bracts entire, not glandular ..... 72. *Prismatomeris*
- 68b. Fruit dry and capsular (i.e., dehiscent), indehiscent, or schizocarpous (i.e., splitting into sections); corolla lobes valvate, valvate-induplicate, or imbricate in bud; ovules and seeds several to numerous in each cell and fruit, or 1 per cell and 2 per fruit in *Trailliaedoxa*.
- 79a. Inflorescences racemiform or spiciform, with 1 or a few well-developed main axes bearing pedicels ..... 37. *Hymenodictyon*
- 79b. Inflorescences subcapitate to cymose, with axes of various orders developed to different degrees and flowers usually borne from axes of various orders.
- 80a. Fruit mitriform and laterally markedly flattened (this shape often evident in young developing fruit) ..... 65. *Ophiorrhiza*
- 80b. Fruit ellipsoid to subglobose.
- 81a. Fruit capsular, septicial, 8–50 mm with at least some fruit 10 mm or longer; seeds flattened and often winged; corollas 5–70 mm.
- 82a. Stipules persistent; shrubs, often epiphytic ..... 61. *Neohymenopogon*
- 82b. Stipules caducous; terrestrial shrubs or trees.
- 83a. Corolla lobes valvate in bud, acute; cultivated trees, without petaloid calycophylls ..... 16. *Cinchona*
- 83b. Corolla lobes imbricate in bud, obtuse to rounded; native trees perhaps sometimes cultivated, sometimes with petaloid calycophylls.
- 84a. Calyx lobes 2–2.5 mm; corolla lobes ca. 7 mm; plants sometimes with calycophylls ..... 26. *Emmenopterys*
- 84b. Calyx lobes 8–20 mm; corolla lobes 11–18 mm; plants without calycophylls ..... 48. *Luculia*
- 81b. Fruit indehiscent, schizocarpous, or capsular, septicial or loculicidal, 1–8 mm; seeds flattened and sometimes winged to angled and unwinged; corollas 2–20 mm.

- 85a. Corolla lobes imbricate in bud; fruit capsular, loculicidal, subglobose, woody ..... 96. *Wendlandia*
- 85b. Corolla lobes valvate, valvate-induplicate, or convolute in bud; fruit indehiscent, schizocarpous, or capsular and septicidal or loculicidal, subglobose to ellipsoid, papery to woody, if loculicidal then corolla lobes valvate.
- 86a. Corolla lobes convolute in bud; low shrubs; ovules and seeds 1 per cell .... 93. *Trailliaedoxa*
- 86b. Corolla lobes valvate or valvate-induplicate in bud; low to large shrubs; ovules and seeds several to numerous in each cell.
- 87a. Corolla lobes valvate-induplicate in bud; plants often with petaloid calycophylls ..... 82. *Schizomussaenda*
- 87b. Corolla lobes [simple-]valvate in bud; plants with or without petaloid calycophylls.
- 88a. Inflorescences usually with 1 or several petaloid bracts and/or calycophylls; corolla yellow; capsules septicidal; stipules interpetiolar, persistent ..... 24. *Dunnia*
- 88b. Inflorescences without petaloid bracts or calycophylls; corolla white, pink, blue, purple, or yellow; capsules septicidal or loculicidal or fruit indehiscent; stipules interpetiolar or fused to petiole bases, persistent or caducous.
- 89a. Fruit dehiscent through apical part or splitting into 2 indehiscent valves ..... 35. *Hedyotis*
- 89b. Fruit deeply dehiscent into 2 or 4 separate valves ..... 88. *Spiradiclis*

## 1. ACRANTHERA Arnott ex Meisner, Pl. Vasc. Gen. 1: 162; 2: 115. 1838, nom. cons.

尖药花属 *jian yao hua shu*

Chen Tao (陈涛); Charlotte M. Taylor, Christian Puff

Herbs or subshrubs, unbranched or little branched, unarmed. Raphides absent. Leaves opposite and often clustered at ends of stems, without domatia; stipules persistent or deciduous, interpetiolar, triangular to oblong. Inflorescences terminal or sometimes displaced to pseudoaxillary, borne on principal stems or sometimes short shoots at stem apex or in 1 or both leaf axils, 1-flowered [or cymose to fasciculate and several flowered], bracteate [or bracts reduced]. Flowers pedicellate or subsessile, bisexual, apparently monomorphic. Calyx with ovary portion usually relatively prolonged; limb lobed essentially to base; lobes 4 or 5, often with 1 well-developed colleter in each sinus. Corolla pale green or white to blue or purple, funnellform to campanulate, glabrous inside; lobes 4 or 5, valvate or reduplicate-valvate in bud. Stamens 5, inserted near base of corolla tube, included or exerted; filaments short to well developed, glabrous, free or fused in basal portion; anthers linear, at apex with sharply acute or spurred appendage, these connate into a tube surrounding stigma and united with it at tops of both structures. Ovary 1-celled, ovules many per cell on 2 T-shaped parietal placentas; stigma 1, clavate, relatively large, 10-ridged, sometimes fused at top to anther appendages. Fruit baccate or perhaps occasionally tardily capsular with irregular dehiscence, fleshy, ovoid to cylindrical or turbinate, color not reported, with calyx limb persistent; seeds numerous, reddish brown or nearly black, small, compressed or lenticular; endosperm fleshy; embryo small, straight.

About 40 species: China, India, Indonesia, Malaysia, Sri Lanka, Thailand, Vietnam, with most species apparently in Borneo; one species (endemic) in China.

This genus was monographed by Bremekamp (J. Arnold Arbor. 28: 261–308. 1947), who named a number of subgenera and series. C. Y. Wu's new species did not fit into Bremekamp's classification; consequently, he described a new monotypic subgenus for it, *Acranthera* subg. *Sinacranthera* C. Y. Wu, distinguished from *A. subg. Acranthera* and *A. subg. Androtropis* Bremekamp by its funnellform corollas, inflorescences borne on opposite brachyblasts bearing two rudimentary leaves, and red to purple corolla color (vs. basal part of corolla cylindrical, inflorescences borne at stem apices, and blue corollas in *A. subg. Acranthera* and inflorescences borne at stem apices and pale green corollas in *A. subg. Androtropis*) and from the other subgenera by its well-developed, subglobose disk (vs. inconspicuous and presumably flattened). *Acranthera* is considered based on recent molecular and some morphological data to be a rather isolated basal lineage in Rubiaceae: its closest relative is probably *Coptosapelta*, and these two genera are probably most closely related to *Luculia* (Alejandro et al., Amer. J. Bot. 92: 544–557. 2005; Rydin et al., Pl. Syst. Evol. 278: 101–123. 2009).

Puff et al. (Ann. Missouri Bot. Gard. 82: 357–382. 1995) concluded that the flowers have an “anther-style and stigma complex” that is unique in Rubiaceae and suggested that at least some *Acranthera* species may be buzz-pollinated. Bremekamp described the ovaries as 2-celled with laminar axile placentas, but Puff et al. showed that the ovaries are actually 1-celled, with parietally inserted placentas that are T-shaped and meet closely enough in the middle to appear superficially to be borne on a median septum, though there is none.

**1. *Acranthera sinensis*** C. Y. Wu, Acta Phytotax. Sin. 6: 295. 1957.

中华尖药花 zhong hua jian yao hua

Herbs or subshrubs, 40(–100) cm tall, with tissues often turning black when dry; branches generally quadrangular, densely hirsute to strigose and strigillose becoming glabrescent with age. Petiole 1–7 cm, strigose to strigillose; leaf blade thinly papery to membranous, elliptic or obovate, 8–22 × 4.5–9 cm, adaxially sparsely to moderately hirsute to hispid, abaxially strigillose to strigose or hispid with pubescence denser along principal veins, base acute or cuneate, margins ciliolate, apex acuminate or acute; secondary veins 9–11 pairs; stipules persistent, broadly ovate to triangular, 1–3 mm, glabrescent, cuspidate or 2- or 3-dentate. Inflorescences terminal, pseudoaxillary, and/or axillary on short shoots, 1-flowered, short shoot reduced to developed (appearing as base of articulate pedun-

cle), to 2 mm; peduncle (i.e., directly subtending flower) 3–4 cm; bracts lanceolate, 2–3 mm, acute. Calyx strigillose to strigose or pilose; ovary portion cylindrical to obconical, 3–4 cm; lobes linear-lanceolate, 2.7–4 cm. Corolla purple outside and pink inside, funnellform, outside hirtellous to tomentulose; tube ca. 45 mm; lobes ovate, ca. 10 mm, obtuse then abruptly acuminate with tip ca. 1.5 mm. Filaments free; anthers 6–8 mm, with connective spurred at apex. Berry compressed cylindrical, 40–45 × ca. 5 mm, bisulcate; seeds with testa reticulate. Fl. Apr–Jun, fr. Jun–Oct.

- Forests on mountain slopes; 1000–1500 m. SE Yunnan.

Wu in the protologue explicitly designated two syntypes, *H. T. Tsai* 55229 collected on 19 May 1934 as the “typus florifer” and *H. T. Tsai* 60568 collected on 29 Jun 1934 as the “typus fructifer”; his species was published in 1957, so this name is validly published in spite of the lack of a single holotype.

## 2. *ADINA* Salisbury, Parad. Lond. t. 115 [“116”]. 1808.

水团花属 shui tuan hua shu

Chen Tao (陈涛); Charlotte M. Taylor

Shrubs or small trees, unarmed, often deciduous; buds conical. Raphides absent. Leaves opposite, distichous or decussate, usually with domatia; stipules persistent or deciduous, interpetiolar, bifid, nodes with a ring of persistent trichomes exposed after stipules fall. Inflorescences terminal and/or in axils of uppermost leaves, capitate with 1[to several] globose heads, pedunculate with peduncles usually articulate in basal half and bearing stipuliform bracts at middle, many flowered, bracteate; bracteoles linear to linear-spatulate. Flowers sessile, bisexual, monomorphic. Calyx limb 5-lobed. Corolla white, salverform to slenderly funnellform, glabrous inside; lobes 5, valvate in bud. Stamens 5, inserted in upper part of corolla tube, partially to fully exserted; filaments short, glabrous; anthers basifixed. Ovary 2-celled, ovules many in each cell, pendulous on axile placentas attached to upper 1/3 of septum; stigma globose to obovoid, exserted. Fruiting heads globose, at maturity shattering easily. Fruit capsular, obconic, septically then loculicidally dehiscent into 4 valves separating from base to apex from each other and from septum, cartilaginous to papery, with septum persistent or tardily deciduous, with calyx limb persistent on septum; seeds numerous, small, fusiform to oblanceoloid, flattened to rounded, with embryo portion obovoid, ellipsoid, oblong, or trigonous, sometimes with short wing at one or both ends.

Four species: China, Japan, Korea, Thailand, Vietnam; three species in China.

- 1a. Deciduous low shrubs; leaves distichous, subsessile to shortly petiolate, petioles to 2 mm, leaf blade 2.5–4 × 0.8–1.2 cm; flowering heads borne separately on axillary or sometimes apically paired peduncles ..... 3. *A. rubella*
- 1b. Evergreen shrubs or small trees; leaves decussate, petiolate, petioles 2–12 mm, leaf blade 4–18 × 1.5–6 cm; flowering heads borne separately on axillary or sometimes apically paired peduncles and/or infrequently or often in cymes of 3 or 5.
- 2a. Leaf blade 4–12 × 1.5–3 cm, abaxially glabrous or sparsely puberulent on costa, petioles 2–6 mm; stipules persistent to caducous, 3–8 mm, puberulent to glabrous, lobes lanceolate to ovate; flowering heads infrequently in cymes of 3 ..... 1. *A. pilulifera*
- 2b. Leaf blade 6–18 × 2.3–6 cm, abaxially sparsely to densely puberulent on veins to throughout, petioles 3–12 mm; stipules caducous, 4–5 mm, glabrous, lobes narrowly triangular; flowering heads often in cymes of 3 or 5 ..... 2. *A. pubicostata*

**1. *Adina pilulifera*** (Lamarck) Franchet ex Drake, J. Bot. (Morot) 9: 207. 1895.

水团花 shui tuan hua

*Cephalanthus pilulifer* Lamarck, Encycl. 1: 679. 1785; *Adina globiflora* Salisbury; *A. globiflora* var. *tonkinensis* Pitard; *A. pilulifera* var. *tonkinensis* (Pitard) Merrill ex H. L. Li.

Shrubs or small trees, evergreen, 1–5(–10) m tall; branches angled to terete, puberulent to glabrescent, often lenticellate, with bark usually gray. Leaves decussate; petiole 2–6 mm, gla-

brous or puberulent; blade drying papery to stiffly papery, narrowly elliptic, elliptic-lanceolate, obovate-oblong, oblanceolate, or obovate-oblanceolate, 4–12 × 1.5–3 cm, adaxially glabrous, abaxially glabrous or sparsely puberulent on costa, base acute to cuneate or obtuse, apex acute to acuminate with tip usually ultimately blunt; secondary veins 6–12 pairs, usually with foveolate and/or pilosulous domatia; stipules persistent to caducous, in outline ovate, 3–8 mm, puberulent to glabrous, deeply bifid, lobes lanceolate to ovate, acute to acuminate, erect to spreading. Inflorescences puberulent to glabrous; peduncles 2–5 cm, with bracts ca. 2 mm; flowering heads borne separately on

axillary or sometimes apically paired peduncles and/or infrequently in cymes of 3, 4–6 mm in diam. across calyces, 8–12 mm in diam. across corollas; bracteoles linear to linear-clavate, 1.3–1.8 mm. Calyx puberulent to glabrescent; ovary portion obconic, 0.5–1 mm, surrounded at base by a strigose ring; limb deeply lobed, lobes linear-oblong or spatulate, 1–1.8 mm, with apex thickened. Corolla white, narrowly funnelform, outside puberulent or hirtellous to glabrous; tube 2–3.5 mm; lobes ovate-oblong, 0.5–1 mm, obtuse. Stigma globose to obovoid, ca. 0.2 mm, exserted for 3–5 mm. Fruiting heads 7–11 mm in diam. Capsules obcuneate, 2–5 mm, puberulent to glabrescent; seeds ca. 2 mm. Fl. Jun–Sep, fr. Jul–Dec.

Thickets or sparse forests at streamsides, at roadsides, or in valleys; 200–400 m. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hunan, Jiangsu, Jiangxi, Yunnan, Zhejiang [Japan, Vietnam].

H. L. Li (J. Arnold Arbor. 25: 317. 1944) recognized *Adina pilulifera* var. *tonkinensis* for Chinese plants from Guangxi, Hainan, and Yunnan but did not there explain their separation from the typical variety; no subsequent authors, including H. H. Hsue and H. Wu (in FRPS 71(1): 274–275. 1999), have recognized infraspecific taxa within this widespread species.

## 2. *Adina pubicostata* Merrill, J. Arnold Arbor. 21: 385. 1940.

毛脉水团花 mao mai shui tuan hua

Shrubs or small trees, evergreen, 1–8 m tall; branches angled to terete, puberulent to glabrescent, often lenticellate, with bark usually grayish to reddish brown. Leaves decussate; petiole 3–12 mm, glabrous to densely puberulent; blade drying papery to stiffly papery, narrowly elliptic, elliptic-oblong, lanceolate, or oblanceolate, 6–18 × 2.3–6 cm, adaxially glabrous, abaxially sparsely to densely puberulent on veins to throughout, base acute to cuneate or obtuse, apex acute to acuminate with tip usually ultimately blunt; secondary veins 6–12 pairs, usually with foveolate and/or pilosulous domatia; stipules caducous, in outline ovate, 4–5 mm, glabrous, deeply bifid, lobes narrowly triangular, acute, erect to spreading. Inflorescences densely puberulent; peduncles 2–5 cm, with bracts ca. 2 mm; flowering heads borne separately on axillary or sometimes apically paired peduncles and/or often in cymes of 3 or 5, 6.5–7 mm in diam. across calyces, 10–11 mm in diam. across corollas; bracteoles linear to linear-clavate, 1–2 mm. Calyx puberulent to glabrescent; ovary portion obconic, 0.5–1 mm, surrounded at base by a pilosulous ring; limb deeply lobed; lobes narrowly spatulate, ca. 1 mm, with apex cucullate to thickened. Corolla white, narrowly funnelform, outside puberulent to glabrous; tube 2–3 mm; lobes ovate, 1–1.5 mm, subacute. Stigma globose to obovoid, ca. 0.2 mm, exserted for 3–5 mm. Fruiting heads 8–9 mm in diam. Capsules obcuneate, 2–2.5 mm, pilosulous at apex to

glabrescent in lower portions, with persistent calyx lobes (on persistent septum) 1.2–2 mm; seeds 1.2–2 mm. Fl. Jun, fr. Jul–Nov or rarely into Jan.

Forests; 400–1200 m. Guangxi, Hunan [Vietnam].

This species has previously been included in *Adina pilulifera* (Ridsdale, Blumea 24: 357–358. 1979; H. H. Hsue & H. Wu, FRPS 71(1): 275. 1999); however, with more material now available it can be clearly distinguished from that species.

## 3. *Adina rubella* Hance, J. Bot. 6: 114. 1868.

细叶水团花 xi ye shui tuan hua

Low shrubs, deciduous, 1–3(–6) m tall; branches angled to terete, puberulent to tomentulose or glabrescent, sometimes lenticellate, with bark usually reddish brown. Leaves distichous, subsessile to shortly petiolate; petiole to 2 mm; blade drying papery, lanceolate, ovate-lanceolate, lanceolate-elliptic, or ovate-oblong, 2.5–4 × 0.8–1.2 cm, adaxially puberulent to glabrous, abaxially glabrescent to puberulent or sparsely pilosulous at least along veins, base obtuse to rounded, apex acute or acuminate; secondary veins 5–7 pairs, with pilosulous domatia; stipules persistent to deciduous, ligulate to ovate in outline, 2–5 mm, puberulent to glabrous, deeply bilobed, lobes narrowly triangular, acute to acuminate, erect to reflexed. Inflorescences densely puberulent or strigillose to glabrescent; peduncles 1–5 cm, with bracts 2–4 mm; flowering heads borne separately on axillary or sometimes apically paired peduncles, 4–7 mm in diam. across calyces, 10–12 mm in diam. across corollas; bracteoles linear or linear-clavate, 1–2 mm. Calyx puberulent to glabrescent; ovary portion obconic, 0.8–1 mm; limb deeply lobed, lobes spatulate or spatulate-clavate, 1–2 mm, at apex thickened, rounded, papillose. Corolla white or flushed with pink or purple on lobes, slenderly funnelform, outside glabrescent, puberulent, or hirtellous with trichomes often purple-red; tube 2–3 mm; lobes deltoid to ligulate, 0.5–1 mm, acute to obtuse. Stigma obovoid, 0.2–0.3 mm, exserted for 3–4 mm. Fruiting heads 8–12 mm in diam. Capsules oblong-obcuneate, 3–4 mm, puberulent, hirtellous, or glabrescent; seeds ca. 1.5 mm. Fl. and fr. May–Dec.

Wet sites at streamsides, riversides, and sand beaches; below 100–600 m. Fujian, Guangdong, Guangxi, Hunan, Jiangsu, Jiangxi, Shaanxi, Zhejiang [Korea].

This is a widespread and frequently collected species. The stipules are sometimes completely split, with the lobes falling separately, and can be confused with triangular entire stipules if care is not taken. How (Sunyatsenia 6: 249. 1946) noted that this species is effective for stabilization of slopes.

## 3. *AIDIA* Loureiro, Fl. Cochinch. 1: 143. 1790.

茜树属 qian shu shu

Chen Tao (陈涛); Charlotte M. Taylor

Shrubs or trees [or rarely vines], unarmed. Raphides absent. Leaves opposite, isophyllous or at nodes with inflorescences often markedly anisophyllous with smaller leaf reduced to a scale and/or deciduous to give an appearance of alternate leaf arrangement, usually with domatia; stipules persistent or usually caducous, interpetiolar or shortly united around stem, triangular. Inflorescences pseudoaxillary, usually produced at nodes with markedly anisophyllous leaves thus appearing “leaf-opposed,” fasciculate to usually

cymose, few to many flowered, sessile to pedunculate, bracteate. Flowers sessile or pedicellate, bisexual, monomorphic. Calyx limb cupular or campanulate, 4- or 5-lobed or -denticulate. Corolla white, yellow, or green sometimes flushed with pink or red, salverform, pilosulous to villosulous in throat; lobes 4 or 5, convolute in bud, usually strongly reflexed at anthesis. Stamens 4 or 5, inserted in corolla throat, exerted; filaments very short; anthers dorsifixed, exerted. Ovary 2(or 3)-celled, ovules several to many in each cell on axile placentas; stigma clavate, fusiform, or 2-lobed with lobes sometimes coherent or free. Fruit red to orange, baccate, fleshy, globose and smooth or ridged, with calyx limb deciduous; seeds several to numerous, medium-sized, angled to compressed, embedded in pulp.

About 50 species: tropical Africa, S and SE Asia, Oceania; eight species (one endemic) in China.

The Asian and Malesian portion of this genus was reviewed in detail by Ridsdale (Blumea 41: 135–179. 1996), who recognized five sections; all of our species fall in his *Aidia* sect. *Aidia*. An additional species, *A. shweliensis*, was included in *Aidia* by W. C. Chen (in FRPS 71(1): 350. 1999) but is here treated as *Fosbergia shweliensis*. The morphology of *Aidia* was studied in some detail by Tirvengadam and Sastre (Bull. Mus. Natl. Hist. Nat., B, Adansonia 8: 257–296. 1986), who also provided an overview of the taxonomy. Ridsdale (Reinwardtia 12: 289. 2008) treated *A. canthioides* in the genus *Benkara*, but it seems anomalous in that genus and is here retained in *Aidia*. The species circumscriptions of Ridsdale differ from those of W. C. Chen (loc. cit.: 348–356); neither author is completely followed here. Following Ridsdale, here plants with 4-merous flowers are distinguished from those with 5-merous flowers, which results in the separation of *A. racemosa* and *A. cochinchinensis*, both 5-merous representatives of primarily Malesian and Vietnamese species, from the 4-merous, primarily Chinese species *A. henryi*. Following W. C. Chen, *A. henryi* and *A. merrillii* are here considered conspecific. Following Ridsdale, *A. densiflora* (Wallich) Masamune is not treated here as a species found in China, and the names Merrill (Lingnan Sci. J. 14: 61. 1935) considered synonyms of that species (*Randia densiflora* (Wallich) Benth., *R. oppositifolia* Koorders, and *Webera oppositifolia* Roxburgh) are here considered misapplied names that do not correspond to any species in the Chinese flora.

- 1a. Young branches, leaf blade abaxially, and inflorescences densely hirtellous, pilosulous, or tomentulose, with trichomes spreading ..... 5. *A. pycnantha*
- 1b. Young branches, leaf blade abaxially, and inflorescences glabrous, puberulent, or strigillose, with trichomes mostly appressed or leaves sometimes pilose below on principal veins in *A. salicifolia*.
- 2a. Inflorescences fasciculate, or subsessile and congested-cymose with axes short and often monochasial, with bracts nearly as long as internodes of axes, and with pedicels much longer than axes (i.e., at first glance appearing fasciculate or fungoid).
- 3a. Pedicels 5–17 mm; calyx limb 3–5 mm; corolla with tube 8–9 mm, lobes 4–7 mm and shorter than tube ..... 1. *A. canthioides*
- 3b. Pedicels 1–4 mm; calyx limb 1–2.5 mm (unknown in *A. salicifolia*); corolla with tube ca. 3 mm, lobes 4–5 mm and longer than tube (corolla unknown in *A. salicifolia*).
- 4a. Leaf blade narrowly lanceolate to narrowly elliptic, 8.5–23 × 0.5–3 cm, with secondary veins 9–12 pairs; Guangxi ..... 7. *A. salicifolia*
- 4b. Leaf blade elliptic-lanceolate or oblong-lanceolate, 6.2–17.5 × 2.7–6.5 cm, with secondary veins 7–10 pairs; Yunnan ..... 8. *A. yunnanensis*
- 2b. Inflorescences cymose, subsessile to pedunculate, branched to several orders with axes sometimes dichasial or monochasial, with internodes of axes exceeding bracts, with pedicels absent or shorter than peduncle plus branched portion of inflorescence.
- 5a. Calyx limb 5–5.5 mm (including lobes); corolla lobes 9–10 mm ..... 4. *A. oxyodonta*
- 5b. Calyx limb 1–2.5 mm; corolla lobes 5–8 mm.
- 6a. Calyx lobes 4; corolla lobes 4; stipules 6–10 mm; widespread in China ..... 3. *A. henryi*
- 6b. Calyx lobes 5; corolla lobes 5; stipules 3–5 mm; Hainan (*A. cochinchinensis* also in Yunnan).
- 7a. Inflorescence axes dichasial ..... 2. *A. cochinchinensis*
- 7b. Inflorescence axes with branching dichasial at basal nodes but markedly monochasial at distal nodes ..... 6. *A. racemosa*

**1. *Aidia canthioides*** (Champion ex Benth.) Masamune, Trans. Nat. Hist. Soc. Formosa 28: 118. 1938.

香楠 *xiang nan*

*Randia canthioides* Champion ex Benth., Hooker's J. Bot. Kew Gard. Misc. 4: 194. 1852; *Aidia canthioides* var. *lanceolata* Masamune; *Benkara canthioides* (Champion ex Benth.) Ridsdale; *Fagerlindia canthioides* (Champion ex Benth.) Ridsdale.

Shrubs or trees, 1–12 m tall; branches flattened to subterete, glabrous. Petiole 5–18 mm, glabrous; leaf blade drying papery or thinly leathery, oblong-elliptic, oblong-lanceolate, or lanceolate, 4.5–18.5 × 2–8 cm, both surfaces glabrous, base

cuneate to obtuse or shortly rounded, sometimes inequilateral, apex acute to acuminate; secondary veins 3–7 pairs, in abaxial axils usually with foveolate and/or pilosulous domatia; stipules deciduous or sometimes persistent on distalmost nodes, broadly triangular, 3–8 mm, glabrous, apex acute or acuminate. Inflorescences fasciculate or shortly congested-monochasial and subsessile, 2–3 × 3–5 cm, several flowered, glabrescent; bracts ovate, often fused in pairs, 0.5–1 mm, acute to obtuse; pedicels 5–17 mm. Calyx densely to sparsely strigillose; ovary portion obconic, 1–1.5 mm; limb with basal tubular portion 3–5 mm; lobes 5, triangular to deltoid, 0.5–2 mm, acute. Corolla white or yellowish white, glabrous outside; tube 8–9 mm; lobes 5, narrowly spatulate-oblong, 4–7 mm, acute. Berry 5–8 mm in diam.,

sparsely strigillose or glabrous; seeds 6 or 7, flattened, angled, 2–3 mm. Fl. Apr–Jun, fr. May–Feb.

Thickets or forests on hills, on mountain slopes, or at streamsides in valleys; below 100–1500 m. Fujian, Guangdong, Guangxi, Hainan, Taiwan, Yunnan [Japan, Vietnam].

This species was excluded from *Aidia* and treated as *Fagerlindia canthioides* by Ridsdale (Blumea 41: 176. 1996), then as *Benkara canthioides* by Ridsdale (Reinwardtia 12: 289. 2008). This species is here included in *Aidia* because of its apparent lack of lateral short shoots or spines, inflorescences not terminal on developed stems, and apparently bisexual flowers.

**2. *Aidia cochinchinensis*** Loureiro, Fl. Cochinch. 1: 143. 1790.

茜树 qian shu

*Randia cochinchinensis* (Loureiro) Merrill.

Shrubs or trees, 2–15 m tall; branches somewhat flattened to terete, glabrous. Petiole 5–10 mm, glabrous; leaf blade drying leathery or papery, elliptic to lanceolate, 9–15 × 3–5 cm, both surfaces glabrous, base acute to obtuse, apex acute to acuminate; secondary veins 5–7 pairs, in abaxial axils usually with pilosulous and/or foveolate domatia; stipules deciduous after distalmost 2 or 3 nodes, lanceolate to narrowly triangular, 3–5 mm, glabrous, apex acuminate. Inflorescences cymose, 2–6 cm, with axes usually regularly dichasial, glabrous to strigillose; peduncle ca. 0.5 cm; bracts lanceolate, 1–2 mm; pedicels 1–2 mm. Calyx glabrous; ovary portion obconic, ca. 2 mm; limb ca. 2 mm, shallowly toothed; lobes 5. Corolla white, glabrous outside; tube 3–4 mm; lobes 5, narrowly spatulate-oblong, 5–6 mm, obtuse. Berry 4–6 mm in diam. Fl. Apr.

Open mountain slopes; 500–1300 m. Hainan, Yunnan [Vietnam].

**3. *Aidia henryi*** (E. Pritzl) T. Yamazaki, J. Jap. Bot. 45: 338. 1970.

亨氏香楠 heng shi xiang nan

*Randia henryi* E. Pritzl, Bot. Jahrb. Syst. 29: 581. 1901; *Aidia merrillii* (Chun) Tirvengadam; *R. acutidens* Hemsley & E. H. Wilson; *R. caudatifolia* Merrill (1923), not Pitard (1923); *R. merrillii* Chun.

Shrubs or trees, 2–15 m tall; branches somewhat flattened to subterete, glabrous. Petiole 5–18 mm, glabrous; leaf blade drying leathery or papery, elliptic-oblong, oblong-lanceolate, or narrowly elliptic, 9–21.5 × 1.5–8 cm, both surfaces glabrous, base cuneate to obtuse, apex acute to acuminate; secondary veins 5–10 pairs, in abaxial axils usually with foveolate and/or pilosulous domatia; stipules caducous or sometimes persisting on distalmost nodes, lanceolate to narrowly triangular, 6–10 mm, glabrous, apex long acuminate. Inflorescences cymose, 1–7 × 1–10 cm, puberulent, strigillose, or glabrous, with axes dichasial or sometimes congested; peduncle 2–10 mm; bracts lanceolate to triangular or ovate, 0.5–2 mm, obtuse to acute; pedicels 0.5–7 mm. Calyx glabrous to strigillose; ovary portion obconic to cylindrical or narrowly ellipsoid, 1–1.5 mm; limb with tubular portion 1–2.5 mm; lobes 4, triangular to narrowly triangular or lanceolate, 0.5–1.5 mm. Corolla yellow, white, or sometimes red, glabrous outside; tube 3–4 mm; lobes 4, narrowly spatulate-oblong, 5–8 mm, acute to obtuse or rounded. Berry 5–6 mm in diam.; seeds ca. 2 mm. Fl. Mar–Jun, fr. May–Feb.

Thickets or forests at streamsides, on hills, or on mountain slopes; below 100–2400 m. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hubei, Hunan, Jiangsu, Jiangxi, Sichuan, Taiwan, Yunnan, Zhejiang [Japan, Thailand, Vietnam].

As noted above, this species is here circumscribed to generally comprise the plants treated by W. C. Chen (in FRPS 71(1): 354. 1999) as *Aidia cochinchinensis*. The reports of *A. cochinchinensis* (as *Randia cochinchinensis*) from Zhejiang by Qiu and Zhong (Fl. Zhejiang 6: 103. 1986) and from Fujian (Fl. Fujian. 5: 165. 1993) are here treated as reports of *A. henryi*.

**4. *Aidia oxyodonta*** (Drake) T. Yamazaki, J. Jap. Bot. 45: 339. 1970.

尖萼茜树 jian e qian shu

*Randia oxyodonta* Drake, J. Bot. (Morot) 9: 218. 1895.

Shrubs or trees, 2–12 m tall; branches somewhat flattened to subterete, puberulent to glabrous. Petiole 8–13 mm, glabrous; leaf blade drying leathery and often pale yellow adaxially and reddish brown abaxially, elliptic-oblong, lanceolate, or elliptic, 8–19 × 2.3–7.5 cm, glabrous on both surfaces, base obtuse to acute, apex acuminate or acute; secondary veins 7–10 pairs, in abaxial axils often with foveolate and/or pilosulous domatia; stipules generally persistent, ovate to narrowly triangular, 5–15 mm, glabrous, apex long acuminate to aristate. Inflorescences cymose with axes dichasial or often becoming monochasial distally, 4–5 cm, glabrous; peduncle 0.8–1 cm; bracts ovate to subulate, 2–3 mm, acute to acuminate; pedicels 2–5 mm. Calyx glabrous; ovary portion obconic, ca. 1.5 mm; limb with tubular portion campanulate, 5–5.5 mm; lobes 5, subulate or linear-lanceolate, 2–4.5 mm, ciliate to glabrous. Corolla yellowish white, outside glabrous; tube 4–5 mm; lobes oblong-spatulate, 9–10 × 3–5 mm, acuminate. Berry 7–13 mm in diam., glabrous; seeds flattened, ca. 2.5 mm. Fl. Apr–Nov, fr. May–Oct.

Thickets or forests on hills or mountains; 100–1000 m. SW Guangdong, SE Guangxi, Hainan [Vietnam].

The Vietnam checklist (Checkl. Pl. Spec. Vietnam 3: 85. 2005) recognized *Aidia oxyodonta* var. *microdonta* (Pitard) P. H. Hô (Ill. Fl. Vietnam 3: 189. 1993), which is based on *Randia oxyodonta* var. *microdonta* Pitard; presumably if this variety is recognized the Chinese plants fall under *A. oxyodonta* var. *oxyodonta*, but so far Chinese literature has not mentioned these varieties.

**5. *Aidia pycnantha*** (Drake) Tirvengadam, Nordic J. Bot. 3: 455. 1983.

多毛茜草树 duo mao qian cao shu

*Randia pycnantha* Drake, J. Bot. (Morot) 9: 218. 1895; *Aidia acuminatissima* (Merrill) Masamune; *R. acuminatissima* Merrill.

Shrubs or trees, 2–12 m tall; branches terete to flattened, densely tomentulose, pilosulous, or hirtellous with pubescence drying ferruginous, sometimes becoming glabrescent with age. Petiole 5–15 mm, densely hirtellous or pilosulous; leaf blade drying thinly leathery or papery, often reddish brown, elliptic-oblong, oblong-lanceolate, or oblong-oblong-lanceolate, 8–27.5 × 2–10 cm, adaxially glabrous and slightly shiny, abaxially hirtellous or pilosulous with pubescence usually denser on principal

veins, base cuneate to obtuse and sometimes slightly inequilateral, apex acuminate to caudate-acuminate with tip to 2.5 cm and sometimes falcate curved; secondary veins 10–14 pairs, in abaxial axils sometimes with weakly developed pilosulous domatia; stipules deciduous or sometimes persisting on apical 2 or 3 nodes, interpetiolar, lanceolate to narrowly triangular, 8–12 mm, densely strigillose to hirtellous or tomentulose, apex acute to acuminate. Inflorescences cymose with axes markedly dichasial, many flowered, 4–6 × 5–12 cm, branched to several orders, densely hirtellous to pilosulous or tomentulose; peduncle 0.5–1.5 cm; bracts linear-lanceolate, 2–4 mm, acute; pedicels 1–4 mm. Calyx densely hirtellous to strigillose; ovary portion 1–1.5 mm; limb with tubular portion 2–3 mm; lobes 5, narrowly triangular, 1–2 mm, acute to acuminate. Corolla white or pale yellow, outside glabrous; tube ca. 4 mm, densely villous in throat; lobes 5, oblong-obovate or spatulate, 6–9 × 2–2.5 mm, obtuse to rounded. Berry 6–8 mm in diam., sparsely strigillose to hirtellous or subglabrous; seeds ca. 2 mm. Fl. Mar–Sep, fr. Apr–Dec.

Thickets or forests at streamsides, in fields or valleys, or on hills or mountain slopes; near sea level to 1000 m. Fujian, Guangdong, Guangxi, Hainan, Yunnan [Vietnam].

**6. *Aidia racemosa*** (Cavanilles) Tirvengadam, *Nordic J. Bot.* 3: 455. 1983.

总状茜草树 zong zhuang qian cao shu

*Stylcoryna racemosa* Cavanilles, *Icon.* 4: 46. 1798; *Randia racemosa* (Cavanilles) Fernández-Villar (1880), not Roxburgh (1824); *R. suishaensis* Hayata.

Trees to 25 m tall; branches somewhat flattened becoming subterete, glabrous. Petiole 5–6 mm, glabrous; leaf blade drying thinly leathery, lanceolate to elliptic-oblong, 7–12 × 2–4 cm, glabrous on both surfaces, base acute to cuneate, apex acute; secondary veins 4 or 5 pairs, in abaxial axils usually with foveolate and/or pilosulous domatia; stipules caducous, shortly united around stem, narrowly triangular, 3–5 mm, glabrous, apex acuminate. Inflorescences cymose, ca. 3 × 4–6 cm, glabrescent, with axes becoming monochasial distally; peduncle ca. 0.5 cm; bracts triangular, 1–1.5 mm, acute; pedicels 1–3 mm. Calyx glabrous; ovary portion ellipsoid, ca. 1 mm; limb ca. 1.5 mm, shortly dentate to denticulate; teeth 5. Corolla white, outside glabrous; tube ca. 4 mm; lobes 5, narrowly spatulate-oblong, 5–5.5 mm, adaxially strigillose, obtuse to rounded. Berry 4–8 mm in diam., glabrous.

Forests; elevation in China not noted on specimens [ca. 200 m to probably higher]. Hainan [Indonesia, Malaysia, New Guinea, Philippines, Thailand; Australia, Pacific islands].

**7. *Aidia salicifolia*** (H. L. Li) T. Yamazaki, *J. Jap. Bot.* 45: 339. 1970.

#### 4. **ALLEIZETTELLA** Pitard in Lecomte, *Fl. Indo-Chine* 3: 278. 1923.

白香楠属 bai xiang nan shu

Chen Tao (陈涛); Charlotte M. Taylor

Shrubs, sometimes scandent, perhaps sometimes dioecious, unarmed. Raphides absent. Leaves opposite, sometimes anisophyllous, usually with domatia; stipules caducous or persistent, interpetiolar or shortly united around stem, generally triangular. In-

柳叶香楠 liu ye xiang nan

*Randia salicifolia* H. L. Li, *J. Arnold Arbor.* 24: 456. 1943.

Shrubs, ca. 1 m tall; branches slender, terete, glabrous. Petiole 2–8 mm, glabrous; leaf blade drying papery, dark olive-green adaxially, paler abaxially, narrowly lanceolate to narrowly elliptic, 8–23 × 0.5–3 cm, both surfaces glabrous or sometimes pilose abaxially along principal veins, base cuneate or acute, apex long acuminate; secondary veins 9–12 pairs, in abaxial axils with foveolate domatia; stipules caducous, lanceolate to triangular, 3–10 mm, glabrous, apex long acute to acicular. Inflorescences not seen. Infructescences congested-cymose, subsessile, 0.5–1.5 cm; bracts not described; pedicels in fruit ca. 4 mm. Berry 6–8 mm in diam. Fr. Nov.

• Forests on mountains; 600–1000 m. Guangxi.

Ridsdale (*Blumea* 41: 135–179. 1996) noted that this species is only reliably known from the type collection, though the additional, more broad-leaved collections *Steward et al.* 544 and *Steward et al.* 806 (no herbarium given by him) from “Kweichow” might be conspecific.

**8. *Aidia yunnanensis*** (Hutchinson) T. Yamazaki, *J. Jap. Bot.* 45: 339. 1970.

滇茜树 dian qian shu

*Randia yunnanensis* Hutchinson in Sargent, *Pl. Wilson.* 3: 400. 1916.

Shrubs or trees, 2–7 m tall; branches somewhat flattened to subterete, glabrous. Leaves subsessile to petiolate; petiole to 6 mm, strigillose to glabrous; blade drying papery or thinly leathery and sometimes reddish brown, elliptic-lanceolate or oblong-lanceolate, 6.2–17.5 × 2.7–6.5 cm, adaxially glabrous, abaxially glabrous or sometimes strigose or strigillose along principal veins, base cuneate to shortly rounded, sometimes slightly inequilateral, apex acuminate to caudate-acuminate; secondary veins 7–10 pairs, in abaxial axils sometimes with small foveolate and/or pilosulous domatia; stipules caducous, interpetiolar or shortly united around stem, lanceolate to narrowly triangular, 4–7 mm, strigillose to glabrous, smooth to keeled, apex acute to acuminate. Inflorescences fasciculate, several flowered, strigillose to hirtellous or strigose sometimes becoming glabrescent with age; bracts triangular, 0.5–1 mm, acute; pedicels 2–4 mm. Calyx strigillose; ovary portion obconic to ellipsoid, ca. 1 mm; limb 1–2.5 mm including lobes, shallowly lobed; lobes 4, triangular to broadly triangular, 0.5–0.7 mm, acute. Corolla white, outside glabrous; tube ca. 3 mm, villous in throat; lobes 4, narrowly oblong-spatulate, 4–5 × ca. 2 mm, obtuse to rounded. Berry red, 5–8 mm in diam., strigillose or glabrous. Fl. Mar–May, fr. May–Jan.

Thickets or forests on hills or mountains; 500–1700 m. S Yunnan [Thailand (*Maxwell 97-144*, MO!)].

florescences terminal on principal stems and/or pseudoaxillary on reduced lateral branches, shortly cymose, several flowered, sessile to pedunculate, bracteate. Flowers sessile to pedicellate, bisexual and monomorphic or perhaps sometimes unisexual. Calyx limb 5-lobed. Corolla white, salverform to funnelform, inside pubescent in throat and upper part of tube; lobes 5, convolute in bud. Stamens 5, inserted at upper part of corolla or at throat, included and positioned near base of corolla tube; filaments short; anthers dorsifixed. Ovary 2-celled, ovules 2 or 3 in each cell, on axile placentas; stigma 2-lobed with lobes linear, exserted. Fruit yellowish white, baccate, subglobose to oblate, fleshy, smooth, with calyx limb persistent or tardily deciduous; seeds few to several, medium-sized, ellipsoid to ovoid, embedded in pulp.

Two species: China, Vietnam; one species in China.

Most authors have described *Alleizettella* as having bisexual flowers, but Robbrecht and Puff (Bot. Jahrb. Syst. 108: 122–123, table 7. 1986) suggested it is sometimes dioecious and thus with unisexual flowers.

**1. *Alleizettella leucocarpa*** (Champion ex Benth) Tirvengadam, Nordic J. Bot. 3: 455. 1983.

白果香楠 bai guo xiang nan

*Randia leucocarpa* Champion ex Benth, Hooker's J. Bot. Kew Gard. Misc. 4: 194. 1852; *Aidia leucocarpa* (Champion ex Benth) T. Yamazaki.

Shrubs, perhaps sometimes scandent, 1–3 m tall; branches compressed to subterete or subangled, strigose to strigillose or pilosulous often becoming glabrescent. Leaves equal to somewhat unequal; petiole 4–12 mm, strigose to strigillose; blade drying papery or thinly leathery, abaxially sometimes paler and/or brownish black speckled, oblong-obovate, elliptic-oblong, narrowly elliptic, or lanceolate, 4.5–17 × 1.5–6 cm, adaxially glabrous or sometimes strigillose to hirtellous along principal veins, abaxially glabrous to usually puberulent or hirtellous on blade and strigose to hirtellous along principal veins, base acute to cuneate, apex subacuminate to acuminate; secondary

veins 4–7 pairs, in abaxial axils usually with pilosulous and usually also foveolate domatia; stipules persistent, shortly united around stem, broadly triangular, 4–7 mm, strigose to strigillose, long acuminate. Inflorescences 1–2 cm, densely strigose, strigillose, or hirtellous; bracts triangular to lanceolate, 0.5–2 mm, acute to acuminate; pedicels 2–3.5 mm. Calyx sparsely to densely strigose to strigillose; ovary portion obconic, 1–1.5 mm; limb campanulate, basal tubular portion 1.5–2 mm; lobes triangular to linear, 0.5–1 mm, acute. Corolla funnelform; tube 3–4 mm, outside strigose in upper part, inside villous at throat; lobes subovate to ligulate, 1.5–2 mm, outside puberulent to glabrous, obtuse to acute. Infructescences usually displaced to pseudoaxillary by subsequent stem growth. Fruit subglobose to somewhat oblate, 8–13 mm in diam., strigillose, pilosulous, or glabrous; seeds 2–4, compressed globose, 4–5 mm in diam. Fl. Apr–Jun, fr. Jun–Feb.

Forests or thickets at streamsides in valleys or on mountain slopes; 200–1000 m. Fujian, Guangdong, Guangxi, Hainan [Vietnam].

## 5. *ANTIRHEA* Commerson ex Jussieu, Gen. Pl. 204. 1789.

毛茶属 mao cha shu

Chen Tao (陈涛); Charlotte M. Taylor

*Guettardella* Champion ex Benth.

Trees or shrubs, dioecious, unarmed. Raphides absent. Leaves opposite [or sometimes whorled], often with domatia; quaternary venation lineolate [or sometimes regularly areolate]; stipules caducous or persistent, interpetiolar, generally triangular to oblong. Inflorescences axillary, cymose with axes dichotomous or often markedly scorpioid, few flowered with flowers often fewer on pistillate plants, pedunculate, bracteate or bracts reduced. Flowers sessile, unisexual. Calyx sericeous outside; limb truncate or 4[or 5]-lobed; lobes often unequal. Corolla white or yellow, salverform in staminate flowers, funnelform in pistillate flowers, with tube often prolonged and slender, inside glabrous or pubescent in throat; lobes 4[or 5], obtuse, imbricate in bud. Stamens 4[or 5], inserted in corolla throat, partially exserted; filaments short or reduced; anthers dorsifixed. Ovary 2–8-celled, ovule 1 in each cell, apical and pendulous, with funicle thickened; stigma capitate or 2- or 3-lobed, included. Fruit dark purple, drupaceous, thinly fleshy, ellipsoid to subglobose and smooth, with calyx limb and subtending bracts persistent; pyrene 1, 2–8-celled with 1 seed in each cell, ellipsoid, woody or bony; seeds cylindrical, medium-sized, without endosperm; cotyledons compressed and minute; radicle clavate and ascending.

Thirty-six species: tropical Asia, Australia, Madagascar, Mascarene Islands, Pacific islands; one species (endemic) in China.

*Antirhea* has traditionally included both paleotropical and neotropical species, but the bisexual and polygamous neotropical plants are now included in other genera; even so, some authors still incorrectly give a pantropical range for this genus.

Chaw and Darwin (Tulane Stud. Zool. & Bot. 28: 50, 59, 69. 1992) recognized three subgenera of *Antirhea*. *Antirhea chinensis* is the type of *A.* subg. *Guettardella* (Champion ex Benth) Chaw, the largest subgenus.

**1. *Antirhea chinensis*** (Champion ex Benth) Benth & J. D. Hooker ex F. B. Forbes & Hemsley, J. Linn. Soc., Bot. 23: 384. 1888.

毛茶 mao cha

*Guettardella chinensis* Champion ex Benth, Hooker's J. Bot. Kew Gard. Misc. 4: 197. 1852.

Shrubs, erect, 1–2(–4) m tall; branches subterete to somewhat flattened, moderately to densely strigose, strigillose, or to-

mentulose, often with trichomes of 2 lengths, occasionally becoming glabrescent, often markedly sylleptic from nodes below leaves with markedly elongated lowermost internode. Petiole 4–10 mm, densely strigose to tomentulose; leaf blade drying papery, elliptic-oblong, oblong-lanceolate, oblanceolate, elliptic, or narrowly elliptic, 3–7(–9) × 1–2.5(–3) cm, adaxially glabrous or sparsely strigillose, abaxially densely sericeous to strigillose, base cuneate to acute, margin flat to thinly revolute, apex acuminate; secondary veins 4–6 pairs, usually with well-developed pilosulous domatia; stipules usually persisting with leaves, triangular to narrowly triangular, 2.5–6 mm, abaxially strigose or strigillose to glabrescent, adaxially densely sericeous, acuminate. Inflorescences cymose, dichotomous or with

higher order axes often scorpioid, staminate several flowered, pistillate few to several flowered, sericeous to strigillose; peduncles 1–3 cm; branched portion 1–3 × 1–3 cm; bracts linear to subulate, 1.5–4 mm. Calyx densely sericeous; ovary portion ellipsoid to obconic, 0.5–1 mm; limb deeply lobed, tubular part 0.3–0.5 mm; lobes linear or lanceolate, 0.5–1.5 mm, often unequal. Corolla yellow, outside, densely sericeous; staminate tube 6–9 mm, pistillate 3–6 mm, inside glabrous or sparsely sericeous in lower portion; lobes ovate, 1–2 mm, obtuse. Drupe ellipsoid-oblong or ellipsoid, 5–7 × 3–4 mm, sparsely strigose; pyrene 2–5-celled, angled to ridged. Fl. Apr–Jun, fr. Oct–Nov.

- Forests, thickets; 100–1700 m. Fujian, Guangdong, Hainan.

## 6. ARGOSTEMMA Wallich in Roxburgh, Fl. Ind. 2: 324. 1824.

雪花属 xue hua shu

Chen Tao (陈涛); Charlotte M. Taylor

Herbs, unarmed, often reduced and/or monocaulous, often rhizomatous or tuberous, usually notably fleshy; stems flattened to subterete. Raphides present. Leaves opposite, apparently verticillate due to closely set stem nodes and/or leaflike stipules, or slightly to markedly anisophyllous and apparently alternate, decussate or distichous, without domatia; stipules persistent or deciduous, interpetiolar, entire or bilobed, sometimes leaflike and thus apparently absent. Inflorescences terminal or sometimes pseudoaxillary, fasciculate, cymose-corymbiform, or umbelliform, several flowered, few flowered, or reduced to 1 flower, sessile to pedunculate, bracteate with bracts sometimes fused into an involucre or sometimes with bracts very reduced. Flowers pedicellate or sessile, bisexual or monomorphic, sometimes somewhat zygomorphic, usually nodding. Calyx limb deeply 4- or 5-lobed. Corolla white, broadly rotate (i.e., “*Solanum*-like”) to campanulate (i.e., bell-shaped), glabrous inside; lobes 4 or 5, valvate in bud. Stamens 4 or 5, inserted near base of corolla tube, partially to fully exerted; filaments reduced or developed and free, coherent, or fused in middle portions into a tube; anthers free or usually coherent into a tube, with longitudinal slits or terminal pores, sometimes with connective prolonged at apex. Ovary 2-celled, ovules numerous in each cell on axile placentas attached near top of septum; stigma capitate or 2-lobed, included or exerted. Fruiting pedicels usually becoming thickened and erect. Fruit capsular, subglobose to obovoid, dehiscent through apical operculum formed from disk portion, leathery or membranous, often becoming black, with calyx limb persistent, with endocarp and septum becoming notably fibrous; seeds numerous, small, flattened to angled, with testa reticulate; endosperm fleshy.

At least 106 species: Bhutan, Cambodia, China, India, Indonesia, Japan, Laos, Malaysia, Myanmar, Nepal, New Guinea, Philippines, Thailand, Vietnam; two species endemic to W Africa; six species (four endemic) in China.

The morphology and anatomy of the androecium of *Argostemma* were detailed by Puff et al. (Ann. Missouri Bot. Gard. 82: 358–366. 1995), who noted an absence of nectaries and probable buzz-pollination of flowers with both linear and poricidal anther dehiscence. Bremer (Ann. Missouri Bot. Gard. 76: 7–49. 1989) reported that the inner layers of the fruit become fibrous and trap seeds inside, with some of them sprouting while still in the capsule in an unusual form of vivipary. *Argostemma* was studied in Thailand by Sridith (Thai Forest Bull., Bot. 27: 86–137. 1999) and Sridith and Puff (Thai Forest Bull., Bot. 28: 123–137. 2000). *Argostemma* species apparently vary widely in size of individual plants and vegetative organs probably in relation to environmental factors.

- 1a. Leaves subsessile, most of them apparently in whorls of 4 at tops of stems, slightly to markedly unequal; anthers free, opening by apical pores ..... 5. *A. verticillatum*
- 1b. Leaves equal or unequal in pairs or sometimes apparently alternate due to marked reduction of 1 leaf of a pair, at least larger leaf of a pair clearly petiolate; anthers coherent in a cone, opening by longitudinal slits.
  - 2a. Calyx and fruit pilosulous, strigillose, villosulous, villous, or hirsute.
    - 3a. Calyx and fruit pilosulous or strigillose with generally straight hairs; larger leaf of a pair 1–4 cm ..... 1. *A. discolor*
    - 3b. Calyx and fruit densely villous, villosulous, or hirsute with usually crisped hairs; larger leaf of a pair 2.5–10 cm ..... 4. *A. solaniflorum*
  - 2b. Calyx and fruit glabrous or puberulent.
    - 4a. Corolla lobes ovate, ca. 5 mm ..... 3. *A. saxatile*
    - 4b. Corolla lobes lanceolate, 8.5–11 mm.
      - 5a. Leaf blade brownish yellow abaxially when dry, with secondary veins not visible; larger leaf of a pair 1–4 × 0.6–1.5 cm ..... 2. *A. hainanicum*
      - 5b. Leaf blade pale abaxially when dry, with secondary veins visible; larger leaf of a pair 2–6 × 1.5–2.5 cm ..... 6. *A. yunnanense*

**1. *Argostemma discolor*** Merrill, Philipp. J. Sci. 23: 265. 1923.异色雪花 *yi se xue hua*

Herbs, 7–15 cm tall, little branched; stems prostrate and rooting or with apices ascending, densely strigose to villosulous. Leaves opposite, markedly anisophyllous, in larger leaf of a pair petiole 3–8 mm, villosulous; blade drying papery and pale abaxially, elliptic, elliptic-oblong, or broadly ovate, 10–40 × 7–20 mm, adaxially sparsely strigose to hispid along midrib and near margins, abaxially glabrous on lamina and densely strigose to hispid along veins, base cuneate to obtuse, margin serrate-ciliate, apex acute to obtuse; secondary veins 4–6 pairs; smaller leaf of a pair sessile, suborbicular or broadly ovate, 5–10 mm; stipules persistent, ovate, suborbicular, or obovate, 2–6 mm, glabrescent, ciliate. Inflorescences 2- or 3-flowered, strigose to hispid; peduncles 5–20 mm; bracts triangular to linear, 1–3 mm; pedicels 10–25 mm. Calyx pilosulous or strigillose; hypanthium portion obconic, 1–1.5 mm; lobes 5, triangular to lanceolate, 1.5–2 mm. Corolla white, rotate, glabrous; tube ca. 2 mm; lobes 5, lanceolate, 6–7 mm, ciliate. Stamens 5; anthers coherent, dehiscent by longitudinal slits, with connective prolonged. Capsules subglobose or obovoid, ca. 3 mm in diam. Fl. Mar–May, fr. Sep–Oct.

- Dense forests; 500–1500 m. Hainan.

**2. *Argostemma hainanicum*** H. S. Lo, Bull. Bot. Res., Harbin 6(4): 46. 1986.海南雪花 *hai nan xue hua*

Herbs, 10–20 cm tall; stems grayish black when dry, suberect or creeping, densely strigose-villous becoming glabrescent. Leaves opposite, anisophyllous; blade drying black adaxially, dark brown abaxially, oblong-lanceolate or oblong-ovate, 10–40 × 6–12(–15) mm, both surfaces strigose on midrib and sometimes near margins, base obtuse, margin entire or erose to ciliate, apex acute or shortly acuminate; secondary veins not visible; smaller leaf of a pair subovate, 2–8(–10) mm. Inflorescence 1- or 2-flowered, villous to glabrescent; peduncles 1–2 cm; bracts lanceolate, 1.5–2 mm. Calyx puberulent or subglabrous; lobes 5. Corolla white, rotate, glabrous; lobes 5, lanceolate, ca. 1 cm. Stamens 5; anthers coherent, dehiscent by longitudinal slits, with connective prolonged. Capsules slightly cordate, maybe didymous, ca. 5 × 7–8 mm, glabrous. Fl. May.

- Valleys or watersides in dense forests. Hainan (Ledong).

**3. *Argostemma saxatile*** Chun & F. C. How ex W. C. Ko, Fl. Hainan. 3: 578. 1974.岩雪花 *yan xue hua*

Herbs, 5–15 cm tall, unbranched or sometimes few branched; stems prostrate and rooting near base, ascending at apex, villous. Leaves opposite, markedly anisophyllous, in larger of a pair petiole 3–5 mm, pilose; blade drying thinly papery and pale abaxially, oblong-elliptic or ovate, 15–55 × 8–18 mm, adaxially sparsely strigose at least along midrib and margin, abaxially strigose at least along veins, base cuneate to obtuse, apex acute or rarely acuminate; secondary veins 5–7 pairs; smaller leaf of a pair sessile, ovate, ca. 5 mm; stipules

persistent, subovate, ca. 1 mm, glabrescent. Inflorescences umbelliform or racemiform, 2–4-flowered, glabrous; peduncles 1 or 2, 1–3 cm; bracts ovate, 2–4 mm; pedicels 1–3 cm. Calyx glabrous; hypanthium portion obconic, 2–2.5 mm; lobes 5, broadly triangular, 1.5–2 mm. Corolla white, apparently rotate, glabrous or subglabrous; tube 1.5–2 mm; lobes 5, ovate, ca. 5 mm. Stamens 5; anthers coherent, dehiscent by longitudinal slits, with prolonged connective. Capsules not seen. Fl. Mar.

- Wet sites in dense forests; ca. 600 m. SW Guangxi.

**4. *Argostemma solaniflorum*** Elmer, Leaflet Philipp. Bot. 1: 2. 1906.水冠草 *shui guan cao*

*Argostemma iriomotense* Masamune; *A. taiwanense* S. S. Ying.

Herbs, to 30 cm tall, sometimes branched; stems erect, puberulent or villosulous to glabrescent. Leaves opposite, slightly to markedly anisophyllous, in larger leaf of a pair petiole 0.5–3 cm, villosulous to glabrescent; blade drying membranous, ovate, lanceolate, or elliptic-oblong, 25–100 × 12–30 mm, adaxially glabrous or sparsely hirsute or pilose, abaxially pilosulous or villosulous along principal veins and glabrous on lamina, base cuneate to obtuse, margin entire and glabrous, apex acute to weakly acuminate; secondary veins 7 or 8 pairs; stipules persistent, oblong-elliptic or ovate, 3–7 mm, glabrescent, obtuse. Inflorescences cymose, 1–6-flowered, strigillose or villosulous to glabrescent; peduncles 1–2.5 cm; bracts triangular and 1–3 mm or resembling reduced leaves and stipules; pedicels 5–20 mm. Calyx villous, villosulous, or hirsute; hypanthium portion subglobose, ca. 1.5 mm; lobes 5, triangular, ca. 1.5 mm. Corolla white, rotate, glabrous; tube ca. 1.5 mm; lobes 5, narrowly lanceolate, ca. 7 mm, marginally densely ciliate. Stamens 5; anthers coherent, 5.5–7 mm, dehiscent by linear slits. Capsules cupuliform, 2–3 mm, leathery, densely hirsute or villosulous, with persistent calyx limb to 3 mm. Fl. Mar–Apr, fr. Jul.

Shady and moist streamsides; below 100–500 m. Taiwan [Japan (Ryukyu Islands), Philippines].

This species appears to vary widely in size of the plants, leaf size, and pubescence; it has sometimes been characterized (e.g., FRPS 71(1): 180–182. 1999) based only on larger plants, as described in the protologue. The two synonymous names listed here were not included in FRPS but were cited in Fl. Taiwan (ed. 2, 4: 247. 1998).

**5. *Argostemma verticillatum*** Wallich in Roxburgh, Fl. Ind. 2: 325. 1824.小雪花 *xiao xue hua*

Dwarf herbs, 2–7 cm tall, unbranched, borne from subglobose tubers; stems erect, puberulent to glabrous. Leaves clustered at stem apex and usually apparently 4-verticillate, anisophyllous, sessile; blade drying membranous to thinly papery, ovate, elliptic, elliptic-oblong, or obovate, 10–70 × 7–25 mm, both surfaces glabrous [or sometimes sparsely villosulous to villous], base obtuse to acute, apex acute to obtuse or shortly acuminate; secondary veins 4–7 pairs; stipules deciduous, elliptic to orbicular, 2–3 mm, obtuse to rounded. Inflorescences

cymose to umbelliform, 2- to several flowered, glabrous; peduncles 1–3, 0.7–2 cm; bracts ligulate to ovate, 1–2 mm; pedicels 5–10 mm. Calyx glabrous; hypanthium portion broadly campanulate to obconic, ca. 1 mm; lobes 5, subtriangular, ca. 1 mm. Corolla white, rotate, glabrous; tube ca. 1 mm; lobes 5, oblong-lanceolate to triangular, 3–5 mm. Stamens 5; anthers free, 2–3 mm, poricidal. Capsules obovoid, ca. 2 mm, with persistent calyx limb to 2 mm. Fl. Jun.

Streamsides in forests; ca. 1500 m. S Yunnan [Bhutan, NE India, Myanmar, Nepal, Vietnam].

This species was reported from Thailand by Sridith (Thai Forest Bull., Bot. 27: 118. 1999) and as having filaments fused at their middles into a tube, but according to the Chinese specimens studied and descriptions of this species in other regions (e.g., Fl. Bhutan 2(2): 756. 1999) the filaments are free. The Thai distribution is provisionally excluded here pending further study of the delimitation of this species.

**6. *Argostemma yunnanense*** F. C. How ex H. S. Lo, Bull. Bot. Res., Harbin 6(4): 45. 1986.

滇雪花 dian xue hua

Herbs, 6–20 cm tall; stems procumbent and rooting with apices ascending, densely crisped pubescent. Leaves opposite, anisophyllous, in larger leaf of pair petiole to 1 cm; blade drying pale abaxially, oblong-obovate, 20–60 × 15–25 mm, adaxially sparsely pilose to subglabrous, abaxially pubescent with pubescence denser on midrib and secondary veins, base obtuse, apex acute; secondary veins 7–10 pairs; smaller leaf of a pair subsessile, ovate to suborbicular, 4–6(–10) mm; stipules ovate, 5–7 mm. Inflorescences umbelliform, 2- or 3-flowered; peduncles 2–2.5 cm; bracts lanceolate, 3–5 mm; pedicels 1–1.5 cm. Calyx glabrous; hypanthium ca. 2 mm; lobes 5, broadly triangular, 1–1.2 mm. Corolla white, rotate; tube ca. 2.5 mm; lobes 5, lanceolate, 8.5–11 mm, margins glabrous. Stamens 5; anthers coherent, 4–4.5 mm, dehiscent by longitudinal slits, with prolonged connective ca. 3 mm. Capsules not seen. Fl. May.

• Dense forests; ca. 900 m. Yunnan.

## 7. *ASPERULA* Linnaeus, Sp. Pl. 1: 103. 1753, nom. cons.

车叶草属 che ye cao shu

Chen Tao (陈涛); Friedrich Ehrendorfer

*Asperula* sect. *Chlorostemma* Lange; *Chlorostemma* (Lange) Fourreau.

Subshrubs, perennial, or annual herbs. Raphides present. Leaves opposite, usually with leaflike stipules in whorls of 4–14, sessile to shortly petiolate, without domatia; leaflike stipules rarely reduced. Inflorescences thyrsoid, paniculiform to capitate, with terminal and often also axillary pedunculate to sessile cymes, bracteate with bracts often fused and sometimes involucrel. Flowers pedicellate to sessile, with prophylls, bisexual, monomorphic. Calyx limb reduced, practically absent. Corolla blue, pink, purple, or yellow to greenish or white, salverform, funnellform, campanulate, or sometimes rotate, glabrous inside; lobes 4 or 5, valvate in bud. Stamens 4 or 5, inserted in corolla tube, exerted (or sometimes included); filaments developed to short; anthers dorsifixed. Ovary inferior (hypanthium), 2-celled, ovules 1 in each cell, erect and axile; stigma globose to clavate, often 2-lobed, included or exerted. Fruit schizocarpous, generally didymous, dry; mericarps 2, indehiscent, with 1 seed, subglobose, ellipsoid-oblong, or reniform, smooth to tuberculate, glabrous to pubescent (but never with uncinat hairs); seeds small, with membranous testa; endosperm corneous; embryo curved; cotyledons leaflike; radicle terete, hypogynous.

About 200 species: widespread throughout N Africa, C and SW Asia, and Europe, extending into Australia and New Zealand, greatest species diversity in the dry regions of SW Asia and the E Mediterranean; two species (one introduced) in China.

The circumscription and relationships of *Asperula* were discussed most recently by Ehrendorfer et al. (Fl. Iranica 176: 105–161. 2005). Short references to the position of the genus within the Rubieae-Rubiinae are found in the introduction to the genus *Galium* of the present volume and its Chinese species are keyed out there.

Originally, the Linnaean genera *Asperula* and *Galium* were separated from each other on the basis of their salverform to campanulate vs. rotate corollas only. Sixty years of critical morphological and later DNA-analytical studies (see Natali et al., Opera Bot. Belg. 7: 193–203. 1996; Soza & Olmstead, Taxon 59: 755–771. 2010) have shown that this differentiation often does not reflect true phylogenetic relationships. In some obvious cases (e.g., *A. odorata* Linnaeus to *G. odoratum* (Linnaeus) Scopoli in *G.* sect. *Hylaea* (Grisebach) Ehrendorfer or *G. purpureum* Linnaeus to *A. purpurea* (Linnaeus) Ehrendorfer in *A.* sect. *Thliphthisa* Grisebach), the problem could be solved by a simple nomenclatorial transfer, but in several other cases the problems persist. Even after an effort to redefine the two genera with the help of the presence of prophylls (bracteoles) at the pedicels in *Asperula* vs. their absence in *Galium* (Ehrendorfer et al., Fl. Europaea 4: 3–38. 1976) the two genera are still phylogenetically interdigitated and heterogeneous. Thus, one is still left with a partly provisional classification of *Asperula* as proposed by Ehrendorfer et al. (loc. cit. 2005). Here, we follow FRPS (71(2): 213. 1999) and do not combine the genus *Leptunis* with *Asperula* (as in loc. cit. 2005).

As in *Galium*, the sectional classification of *Asperula* by Ehrendorfer et al. (loc. cit. 2005) does not fully agree with that of Pobedimova et al. (Fl. URSS 23: 205–285. 1958), which was followed by FRPS. In particular, Ehrendorfer et al. (loc. cit. 2005: 131–142, 157–158) placed *A. oppositifolia* in *A.* sect. *Oppositifoliae* Schischkin ex Schönbeck-Temesy and *A. orientalis* in *A.* sect. *Asperula* (*A.* sect. *Sherardianae* Candolle). The two species are keyed out below but are also included in the key to all taxa of Chinese Rubieae found in the present volume under *Galium*.

1a. Perennials, with stems originating from a woody rootstock; leaves at all nodes opposite, 3–6(–15) ×

0.5–1.5(–3) mm, glabrous, stipules reduced; flowers pink to purple ..... 1. *A. oppositifolia*

1b. Herbaceous annuals, with stems from fibrous roots; leaves and leaflike stipules at upper nodes in whorls of 4–8, 1.2–2.5 × 0.2–0.5 cm, glabrous to sparsely hispidulous on lamina and densely antrorsely aculeolate on veins and margins; flowers pale to clear purplish blue ..... 2. *A. orientalis*

**1. *Asperula oppositifolia*** Regel & Schmalhausen in Regel, Descr. Pl. Nov. Rar. 42. 1882.

对叶车叶草 *dui ye che ye cao*

Subshrubs, perennial, originating from a woody rootstock. Stems often ± woody at base, up to 40 cm tall, erect, weakly 4-angled, glabrous to puberulent. Leaves opposite, subsessile; blade drying stiffly papery, linear to linear-lanceolate, 3–6(–15) × 0.5–1.5(–3) mm, glabrous throughout or ± hairy, base and apex acute; secondary veins not evident; stipules 2–4 per pair, reduced and never more than 0.3 mm. Inflorescences terminal and axillary, dichasial, branched to 1–4 orders, glabrous to puberulent; peduncles 1–10(–30) mm; bracts linear to narrowly elliptic (i.e., leaflike), 1–4 mm; pedicels 0–3 mm. Corolla pink to purple, funnellform, glabrous to sparsely pilose outside; tube ca. 2 mm; lobes 4, ovate-oblong, ca. 1.5 mm. Ovary subglobose to narrowly ellipsoid, 0.5–1 mm, glabrous to densely pilosulous. Mericarps ovoid, 1.5–2.5 mm, glabrous to densely pilosulous. Fl. Jun–Jul, fr. Jul–Aug.

Gravel on mountain slopes; ca. 3700 m. Xizang (Zanda) [Afghanistan, Pakistan, Tajikistan].

*Asperula oppositifolia* is a polymorphic species with several subspecies and belongs to the very variable *A. sect. Oppositifoliae* (Ehrendorfer et al., Fl. Iranica 176: 131–142. 2005). As we have not seen material from China, the data presented here are mostly taken from FRPS (71(2): 214. 1999) and do not allow an exact determination. Outside of China, populations of *A. oppositifolia* are found at elevations down to 1350 m. Their leaves are narrow and short relative to the internodes and sometimes deciduous. Thus, the plants appear to consist only of photosynthetic stems with small terminal groups of flowers.

**2. *Asperula orientalis*** Boissier & Hohenacker in Boissier, Diagn. Pl. Orient., ser. 1, 3: 30. 1843.

蓝花车叶草 *lan hua che ye cao*

*Asperula arvensis* Linnaeus subsp. *orientalis* (Boissier & Hohenacker) Thiébaud; *A. azurea* Jaubert & Spach.

Herbs, annual, from fibrous roots. Stems few or solitary, to 30(–40) cm tall, 4-angled, erect, often regularly divaricately branched, glabrous to scaberulous or hispidulous. Leaves and leaflike stipules at middle stem regions in whorls of 4–8, subsessile; blade drying papery, lanceolate, linear-lanceolate, or spatulate, (7–)12–25(–30) × (1.5–)2–5(–10) mm, glabrous to sparsely hispidulous on lamina and densely scaberulous to antrorsely aculeolate on veins and margins, base acute, apex obtuse to rounded; secondary veins not evident. Inflorescences terminal, capitate to subcapitate; peduncles 1.5–4 cm; involucre bracts leaflike, 1–12 mm, white ciliate at margins. Flowers sessile. Corolla pale to clear purplish blue, salverform, outside densely papillose; tube 8–10 mm, dilated in throat around anthers; lobes 4, elliptic to ovate, 2–3 mm, obtuse. Ovary ovoid, ca. 1 mm, glabrescent. Mericarps 1–1.8 mm, glabrous. Fl. Jun–Jul, fr. Aug–Sep.

Cultivated ornamental in Anhui, Jiangsu (Nanjing), and Shaanxi (Xi'an) [native to SW Asia (Georgia, Iraq, Lebanon, Syria, Turkey)].

*Asperula orientalis* is a butterfly-pollinated SW Asiatic member of *A. sect. Asperula*. Pobedimova et al. (Fl. URSS 23: 283. 1958) erroneously gave the name *A. azurea* priority over *A. orientalis*. The other closely related taxa of *A. sect. Asperula* are the smaller-flowered and widespread *A. arvensis* Linnaeus (the conserved type of the genus) and *A. setosa* Jaubert & Spach. The latter has very small flowers, is obviously autogamous, and grows at higher elevations (1200–3200 m) from SW Asia to the Tian Shan and Pamir-Alai. It could be found in the mountains of W China.

## 8. BENKARA Adanson, Fam. Pl. 2: 85, 525. 1763.

筋茜属 *le qian shu*

Chen Tao (陈涛); Charlotte M. Taylor

*Fagerlindia* Tirvengadam; *Griffithia* Wight & Arnott.

Shrubs or small trees, erect to clambering or perhaps scandent, usually armed with paired, ascending, straight to slightly curved, axillary thorns, often with short shoots. Raphides absent. Leaves opposite or sometimes congested to apparently fascicled on lateral short shoots, usually with domatia; stipules caducous, interpetiolar or shortly united around stem, generally triangular, acute to cuspidate. Inflorescences terminal on lateral branches and/or short shoots, 1-flowered or 2- to several flowered and fasciculate to cymose, sessile to pedunculate, bracteate or bracts reduced. Flowers pedicellate, bisexual, monomorphic. Calyx limb 5-lobed, usually with well-developed basal tubular portion. Corolla white to yellow, salverform, usually pubescent in throat; lobes 5, convolute in bud, usually spreading to reflexed. Stamens 5, inserted in corolla throat, partially to fully exerted; filaments short; anthers dorsifixed. Ovary 2-celled, ovules several to many in each cell on axile placentas; stigma clavate to fusiform or 2-lobed with lobes coherent, included to partially exerted. Fruiting pedicels sometimes elongating. Fruit purplish black, baccate, fleshy to leathery or infrequently woody, globose to ellipsoid, smooth, with calyx limb tardily deciduous; seeds several to numerous, medium-sized, angled or ellipsoid, embedded in pulp; testa weakly areolate.

About 19 species: China, India, Indonesia, Japan, Malaysia, Myanmar, Philippines, Thailand, Vietnam; seven species (four endemic) in China.

Ridsdale (Reinwardtia 12: 289–300. 2008) recently reviewed *Oxyceros* and *Fagerlindia* and concluded by re-circumscribing *Oxyceros* Loureiro (Fl. Cochinch. 1: 150. 1790) and synonymizing *Fagerlindia* with *Benkara*. In this new circumscription, *Oxyceros* comprises species distinguished by markedly recurved thorns (or spines), notably *O. horridus* Loureiro, and is not represented (as far as now known) in the Chinese flora. Ridsdale (loc.

cit.) transferred all the Chinese species previously included in *Oxyceros* to *Benkara*, with straight or only slightly curved spines or thorns. One Chinese species included by Ridsdale in *Fagerlindia* and later *Benkara* is here instead treated as *Aidia canthioides*.

*Benkara griffithii* (J. D. Hooker) Ridsdale (Reinwardtia 12: 298. 2008; *Randia griffithii* J. D. Hooker, Fl. Brit. India 3: 112. 1880; *Oxyceros griffithii* (J. D. Hooker) W. C. Chen) is not treated here. See the discussion under *B. forrestii* below.

- 1a. Flowers subsessile to very shortly pedicellate, on pedicels 0.5–1.5 mm ..... 7. *B. sinensis*  
 1b. Flowers pedicellate or pedunculate, on pedicels or peduncles 1–15 mm with at least some of them more than 2 mm.  
 2a. Branchlets and calyx glabrous; corolla white, with tube 14–22 mm and lobes 5–12 mm.  
 3a. Secondary leaf veins 4–6 pairs; calyx lobes 0.5–1.2 mm; plants drying with characteristic yellowed color ..... 5. *B. rectispina*  
 3b. Secondary leaf veins 2 or 3 pairs; calyx lobes 1.5–2 mm; plants drying greenish to grayish ..... 6. *B. scandens*  
 2b. Branchlets and calyx glabrous to puberulent, pilosulous, strigillose, or hirtellous; corolla white or yellow, with tube 3–7 mm and lobes 5–8 mm.  
 4a. Calyx limb with tubular portion 3.5–4 mm; corolla white ..... 1. *B. depauperata*  
 4b. Calyx limb with tubular portion 1–3 mm; corolla white to yellow.  
 5a. Flowers 1 or 2 in fascicles, these sometimes congested and appearing as a cyme; leaves obtuse to rounded and sometimes shortly mucronate at apex ..... 2. *B. evenosa*  
 5b. Flowers 3 to several in cymes branched to 2 or more orders; leaves acute to acuminate at apex with tips sharp to slightly blunt.  
 6a. Corolla with tube 5–6 mm and lobes ca. 5 mm; leaves 1.5–5 cm wide, usually at least some leaves wider than 3 cm ..... 3. *B. forrestii*  
 6b. Corolla with tube ca. 7 mm and lobes ca. 8 mm; leaves 1.5–3 cm wide ..... 4. *B. hainanensis*

**1. *Benkara depauperata*** (Drake) Ridsdale, Reinwardtia 12: 298. 2008.

多刺筋茜 duo ci le qian

*Randia depauperata* Drake, J. Bot. (Morot) 9: 217. 1895; *Canthium spinosissimum* Merrill; *Fagerlindia depauperata* (Drake) Tirvengadam.

Shrubs, 1–3 m tall; branches compressed to terete, puberulent to hirtellous or strigillose, with thorns 4–15 mm. Petiole 2–6 mm, puberulent to hirtellous or strigillose; leaf blade drying thinly papery, ovate, ovate-orbicular, lanceolate, or ovate-lanceolate, 1–8.2 × 0.8–3 cm, adaxially glabrous, abaxially glabrous or strigillose to hirtellous at least on principal veins, base rounded to obtuse or broadly cuneate, apex acute to caudate-acuminate; secondary veins 2–4 pairs, in abaxial axils usually with pilosulous domatia; stipules triangular to narrowly triangular, 3–4 mm, strigillose to puberulent, acuminate to aristate. Inflorescences 1-flowered or cymose and 2- or 3-flowered, puberulent or strigillose to glabrescent; peduncles 3–10 mm, articulate when flowers solitary; bracts lanceolate, 2–3 mm; pedicels 6–10 mm. Calyx limb hirtellous to strigillose; ovary portion obconic, 1–1.5 mm; limb with tube 3.5–4 mm; lobes triangular to linear, 1–2 mm, apex acute. Corolla white, glabrous outside; tube 3–4.5 mm; lobes elliptic-oblong to ligulate, 5–5.5 mm, ciliate, acute. Fruiting pedicels 5–15 mm. Berry globose, 5–6 mm in diam., pilosulous or strigillose to glabrescent; seeds ellipsoid to angled, ca. 3 mm. Fl. Apr, fr. May–Jan.

Forests or thickets on hills; below 100–300 m. Fujian, Guangxi, Hainan [Vietnam].

**2. *Benkara evenosa*** (Hutchinson) Ridsdale, Reinwardtia 12: 298. 2008.

无脉筋茜 wu mai le qian

*Randia evenosa* Hutchinson in Sargent, Pl. Wilson. 3: 400. 1916; *Oxyceros evenosus* (Hutchinson) T. Yamazaki.

Shrubs, ca. 3 m tall; branches compressed to terete, puberulent to glabrous, with thorns 2–14 mm. Petiole 3–5 mm, puberulent to glabrous; leaf blade drying thinly leathery to stiffly papery and dark brown, obovate or elliptic, 2–6 × 1.5–3 cm, both surfaces glabrous, base cuneate to obtuse, apex obtuse to rounded and sometimes shortly mucronate; secondary veins 3–5 pairs, in abaxial axils with foveolate and/or pilosulous domatia; stipules triangular to ovate, 2.5–3 mm, glabrous, acute. Inflorescences 1- or 2-flowered, fasciculate, sometimes clustered on shortened internodes and appearing cymose, puberulent to glabrous; peduncles 5–10 mm, sometimes articulate near base; bracts triangular, ca. 1 mm, ciliate, acute. Calyx glabrous; ovary portion ellipsoid to obconic, 1.5–2 mm; limb with tube 2–3 mm; lobes triangular to linear, 0.5–1 mm. Corolla yellow, glabrous outside; tube 3–5 mm; lobes oblong-elliptic, ca. 6 × 3–3.5 mm, obtuse. Fruiting pedicels 10–17 mm. Berry globose, 5–7 mm in diam., glabrous. Fr. Sep–Oct.

• Forests on mountains; 1300–1600 m. Yunnan.

**3. *Benkara forrestii*** (J. Anthony) Ridsdale, Reinwardtia 12: 299. 2008.

滇筋茜 dian le qian

*Randia forrestii* J. Anthony, Notes Roy. Bot. Gard. Edinburgh 18: 204. 1934.

Shrubs or trees, 2–5 m tall; branches hirtellous or pilosulous to glabrescent, compressed to angled or subterete, with thorns 3–10 mm. Petiole 2.5–10 mm, hirtellous or pilosulous to glabrous; leaf blade drying papery to stiffly papery, brownish green, oblong-ovate, elliptic-lanceolate, or ovate, 3.5–7 × 1.5–5 cm, adaxially glabrous and shiny, abaxially glabrous or sparsely strigillose on principal veins, base cuneate to obtuse or sub-

rounded, apex acute to acuminate; secondary veins 4–6 pairs, in abaxial axils with foveolate and/or pilosulous domatia; stipules lanceolate to triangular, 2–5 mm, strigillose to glabrous, acuminate. Inflorescences cymose, 2.5–3 × 3–4 cm, 5- to several flowered, branched to several orders, pilosulous or hirtellous to glabrous; peduncle 4–10 mm; bracts and bracteoles lanceolate or triangular, 2–4 mm, acute; pedicels 1–3 mm. Calyx puberulent or strigillose to glabrous; ovary portion obconic, ca. 1 mm; limb 2–3 mm, partially lobed; lobes triangular, 1–1.5 mm, acute. Corolla white to greenish white or perhaps yellow, glabrous outside; tube 5–6 mm; lobes spatulate, ca. 5 mm, obtuse. Fruiting pedicels ca. 6 mm. Berry globose, 5–8 mm in diam., glabrous. Fl. Apr–Jun, fr. May–Dec.

• Forests or thickets at streamsides, on hills, or on mountain slopes; 1000–2400 m. Yunnan.

Ridsdale (loc. cit.: 298–299) treated *Benkara griffithii* and *B. forrestii* as two different species, without commentary or a key, and synonymized *Randia hainanensis* under *B. forrestii*. W. C. Chen (in FRPS 71(1): 346. 1999) treated these names as synonyms of *Oxyceros griffithii*. However, *B. forrestii* and *R. hainanensis* were recognized as separate species by Tirvengadam (in herb.), and these appear morphologically distinct as outlined in the key to species above and thus are separated here. These are provisionally treated as endemic pending further study of this genus and specimens from surrounding countries.

#### 4. *Benkara hainanensis* (Merrill) C. M. Taylor, **comb. nov.**

海南筋茜 hai nan le qian

Basionym: *Randia hainanensis* Merrill, Lingnan Sci. J. 11: 58. 1932.

Shrubs, 0.5–2.5 m tall; branches slender, compressed to subterete, glabrous, with thorns 4–7 mm. Petiole 2.5–13 mm, pilosulous to glabrous; leaf blade drying papery, brownish green to dark brown, oblong-ovate, elliptic-lanceolate, or lanceolate, 3–8 × 1.5–3 cm, both surfaces glabrous, base cuneate or obtuse to sometimes subrounded, apex acute to acuminate; secondary veins 3–6 pairs, in abaxial axils with foveolate and/or pilosulous domatia; stipules lanceolate to triangular, 2–4 mm, glabrous, acuminate. Inflorescences cymose, 2.5–3 × 3–4 cm, 3- to several flowered, branched to several orders, glabrous; peduncle 4–7 mm; bracts and bracteoles lanceolate to triangular, 2–6 mm, acute; pedicels 2–3 mm. Calyx glabrous; ovary portion obconic, ca. 1 mm; limb 1–3 mm, partially lobed; lobes triangular, 1–1.5 mm, acute. Corolla white or yellow, glabrous outside; tube ca. 7 mm; lobes spatulate, ca. 8 mm, obtuse and often mucronulate. Fruiting pedicels to 9 mm. Berry globose, 5–8 mm in diam., glabrous. Fl. Apr–Jun, fr. May–Dec.

• Forests or thickets at streamsides, on hills, or on mountain slopes; 200–600 m. Hainan.

W. C. Chen (in FRPS 71(1): 346. 1999) treated this species as a synonym of *Benkara griffithii* (as *Oxyceros griffithii*), and Ridsdale (Reinwardtia 12: 299. 2008) treated it as a synonym of *B. forrestii*; see comments above under *B. forrestii* regarding its separation here.

#### 5. *Benkara rectispina* (Merrill) Ridsdale, Reinwardtia 12: 299. 2008.

直刺筋茜 zhi ci le qian

*Randia rectispina* Merrill, Lingnan Sci. J. 14: 60. 1935; *Oxyceros rectispinus* (Merrill) T. Yamazaki.

Shrubs, 2–4 m tall, sometimes scandent; branches weakly compressed to subterete, glabrous, rather stout, often yellowish white, with thorns 6–14 mm. Petiole 3–6 mm, glabrous; leaf blade drying leathery and usually straw- to brownish yellow, ovate, elliptic-ovate, or elliptic, 1.5–6.5 × 1–3 cm, both surfaces glabrous and rather shiny, base cuneate, obtuse, or subrounded, apex obtuse or slightly rounded or rarely acute; secondary veins 4–6 pairs, in abaxial axils usually with foveolate and/or pilosulous domatia; stipules lanceolate to triangular, ca. 2 mm, acute to caudate or aristate. Inflorescences 1- or less often 2-flowered, glabrescent; peduncles 2–8 mm; bracteoles absent or 2, broadly ovate-triangular, 1.5–2 mm, acute, after falling leaving a persistent pilose ring; pedicels 5–8 mm. Calyx limb glabrous; ovary portion subglobose, ca. 2 mm; limb campanulate, ca. 4.5 × 3 mm, shallowly lobed; lobes triangular, 0.5–1.2 mm, cuspidate. Corolla white, outside glabrous; tube 18–22 mm; lobes elliptic-ovate, 5–6 mm, obtuse. Fruiting pedicels 5–12 mm. Berry globose, 6–10 mm in diam., glabrous; seeds 3–4 mm. Fl. Apr–Jul, fr. Sep–Jan.

• Forests or thickets at seasides or on hills; near sea level to 300 m. Hainan.

#### 6. *Benkara scandens* (Thunberg) Ridsdale, Reinwardtia 12: 300. 2008.

浓子茉莉 nong zi mo li

*Gardenia scandens* Thunberg, *Gardenia*, 17. 1780; *Fagerlindia scandens* (Thunberg) Tirvengadam; *Plectronia levinei* Merrill; *Randia accedens* Hance; *R. scandens* (Thunberg) Lamarck.

Shrubs, 1–3 m tall; branches terete to flattened, glabrous, with thorns 6–12 mm. Petiole 2–5 mm, glabrous; leaf blade drying papery or thinly leathery, ovate, lanceolate, broadly elliptic, or elliptic-oblong, 0.6–5.5 × 0.4–2.5 cm, both surfaces glabrous, base cuneate, margins sometimes thinly revolute, apex obtuse or acute; secondary veins 2 or 3 pairs, in abaxial axils usually with foveolate and/or pilosulous domatia; stipules triangular to ovate, 1.5–2 mm, glabrous, acuminate to cuspidate. Inflorescences 1-flowered or cymose and 2- or 3-flowered, glabrescent; peduncles 2–10 mm, articulate when flowers solitary; bracts lanceolate, 1.5–2.5 mm; pedicels 3–10 mm. Calyx glabrous; ovary portion obconic, 1.2–1.5 mm; limb with tube somewhat campanulate, 3.5–4 mm; lobes narrowly triangular, 1.5–2 mm, acute to acuminate. Corolla white, outside puberulent to usually glabrous; tube 14–20 mm; lobes lanceolate, 6–12 mm, acute. Fruiting pedicels 3–12 mm. Berry globose, 5–7 mm in diam., glabrous; seeds ellipsoid to angled, 2–3 mm. Fl. Mar–May, fr. May–Dec.

Thickets in fields or on hills at low elevations. Guangdong, Guangxi, Hainan, Yunnan [Vietnam].

#### 7. *Benkara sinensis* (Loureiro) Ridsdale, Reinwardtia 12: 300. 2008.

筋茜 le qian

*Oxyceros sinensis* Loureiro, Fl. Cochinch. 1: 151. 1790; *Aidia sinensis* (Loureiro) Masamune; *Fagerlindia sinensis* (Loureiro) Tirvengadam; *Randia sinensis* (Loureiro) Schultes.

Shrubs or small trees, sometimes scandent, many branched, 1–7 m tall; branches compressed to terete, rather stout, yellowish brown hirtellous or -pilosulous, with thorns 4–15 mm. Petiole 5–15 mm, yellowish hirtellous to -pilosulous or glabrescent; leaf blade drying papery to thickly papery, ovate-elliptic, elliptic-oblong, or ovate, 2–21 × 1.5–9.5 cm, adaxially glabrous, abaxially glabrescent to strigillose, hirtellous, or pilosulous at least on principal veins, base cuneate or slightly rounded, apex acute or shortly acuminate; secondary veins 5–8 pairs, in abaxial axils with pilosulous domatia; stipules triangular to narrowly triangular, 3–5 mm, strigillose to pilosulous, hirtellous, or glabrescent, long acuminate. Inflorescences congested-cymose, often umbelliform, several to many flowered, 2.5–4 × 3–4.5 cm, densely pilosulous to strigose or strigillose;

peduncle 3–5 mm; bracts lanceolate to ovate, 1.5–2.5 mm, acute to acuminate; pedicels 0.5–1.5 mm. Calyx densely strigose to strigillose; ovary portion ellipsoid to cylindrical, 1–1.2 mm; limb 3–4 mm, shallowly to deeply lobed; lobes narrowly triangular or ovate-triangular, 1–4 mm, acute. Corolla white or yellow, outside puberulent to glabrous; tube (12–)15–24 × 1–4 mm; lobes elliptic-oblong to oblanceolate, 5–9 × 4–4.5 mm, acute. Fruiting pedicels to 5 mm. Berry globose, 8–12 mm in diam., pilosulous to strigillose or glabrous; seeds ca. 5 mm. Fl. Mar–Dec, fr. May–Feb.

Forests, forest margins, or thickets on hills, on mountains, or in fields; near sea level to 1200 m. Fujian, Guangdong, Guangxi, Hainan, Taiwan, Yunnan [Japan, ?Thailand (*Larsen et al.* 43560, MO!), Vietnam].

The shorter measurements here are taken from W. C. Chen (in FRPS 71(1): 345–346. 1999); the specimens studied all have corolla tubes 15–24 mm.

## 9. BRACHYTOME J. D. Hooker, Hooker's Icon. Pl. 11: 70. 1871.

短萼齿木属 duan e chi mu shu

Chen Tao (陈涛); Charlotte M. Taylor

Shrubs or small trees, dioecious or perhaps polygamo-dioecious, unarmed, often with some internodes reduced. Raphides absent. Leaves opposite or often appearing ternate due to reduced internodes and marked anisophylly grouping 2 leaves at 1 node plus a single leaf at another node, apparently without domatia; stipules persistent or deciduous after terminal 2–4 nodes, interpetiolar or shortly united around stem, triangular. Inflorescences pseudoaxillary, usually borne opposite a single leaf of an anisophyllous pair and appearing leaf-opposed or sometimes just above an undeveloped internode at an apparent 3-leaved node, cymose, few to several flowered, subsessile to pedunculate, bracteate. Flowers subsessile to pedicellate, unisexual or perhaps sometimes bisexual. Calyx limb cupular, 5-lobed or -dentate. Corolla white to cream or pale yellow, funnellform to tubular or subrotate, glabrous inside; lobes 5, convolute in bud. Stamens 5, inserted in corolla throat, exerted, with staminodes included; filaments short; anthers dorsifixed. Ovary 2-celled, ovules many in each cell on peltate axile placentas; stigma 2-lobed, grooved striate, partially exerted. Fruit red to orange, baccate, fleshy, globose to ellipsoid, smooth, with calyx limb persistent, often with fruit base and/or pedicels elongating into stipes; seeds numerous, small, cuneate to flattened, with testa reticulate; endosperm fleshy; embryo small, subterete.

About five species: Bangladesh, Cambodia, China, India, Malaysia, Myanmar, Vietnam; three species in China.

The morphology and branching of this genus were studied by Tirvengadam and Sastre (Bull. Mus. Natl. Hist. Nat., B, Adansonia 8: 257–296. 1986).

*Brachytome* was described as polygamo-dioecious in FRPS (71(1): 360. 1999), but this has not been reported by other sources; the genus was described as unisexual by Puff et al. (Rubiaceae of Thailand, 68. 2005).

- 1a. Branches densely strigose, strigillose, hirtellous, or hispidulous ..... 2. *B. hirtellata*  
 1b. Branches glabrous or sparsely to moderately strigose to strigillose when young, becoming glabrescent with age.  
 2a. Infructescences 3–8 × 3–5 cm, with axes and pedicels mostly well developed; stipules 3–8 mm; berry subglobose, ca. 6 × 5 mm ..... 1. *B. hainanensis*  
 2b. Infructescences and infructescences 3–5 × 3–5 cm, with axes and pedicels short to well developed; stipules 6–15 mm; berry ellipsoid, 10–20 × 8–15 mm ..... 3. *B. wallichii*

**1. *Brachytome hainanensis*** C. Y. Wu ex W. C. Chen, Guihaia 7: 298. 1987.

海南短萼齿木 hai nan duan e chi mu

Shrubs, 2.5–3 m tall; branches flattened becoming subterete, glabrous. Petiole 0.4–1.5 cm, glabrous; leaf blade drying papery and usually brown, elliptic-oblong, elliptic, or elliptic-lanceolate, 7–20.5 × 2.5–7 cm, adaxially glabrous, abaxially glabrous or puberulent, base cuneate to obtuse, apex acute to acuminate; secondary veins 8–12 pairs; stipules triangular to

broadly triangular, 3–8 mm, glabrous, acuminate or cuspidate. Inflorescences not seen. Flowers not seen. Infructescences corymbiform-cymose, 3–8 × 3–5 cm, several to many fruited; peduncle 1.5–2 cm; bracts triangular to ovate, 0.5–1 mm, mostly situated at nodes (i.e., branching points); pedicels 3–9 mm. Berry red, ellipsoid to subglobose except with narrow cylindrical base, rounded portion 5–6 × ca. 5 mm plus basal narrow portion ca. 1 mm; seeds yellow, ca. 1.5 mm wide. Fr. Mar.

Forests. Hainan [Vietnam].

**2. *Brachytome hirtellata*** Hu, Bull. Fan Mem. Inst. Biol. 10: 164. 1940.

滇短萼齿木 dian duan e chi mu

Shrubs, ca. 3 m tall; branches somewhat flattened becoming angled and sometimes shallowly channeled, sometimes flexuous, densely hirtellous or hispidulous to strigillose or strigose. Petiole 2–12 mm, densely hirtellous to strigillose or strigose; leaf blade drying membranous or thinly papery, green to yellowish green adaxially, brown or purplish brown abaxially, oblanceolate or oblong-lanceolate to elliptic, 7–21.5 × 2–6 cm, adaxially glabrous or scaberulous to sparsely hirtellous, hispidulous, or strigillose, abaxially glabrescent or densely to sparsely hirtellous or strigillose, base cuneate or acute, apex acute to acuminate; secondary veins 12–20 pairs; stipules ovate to triangular, 4–8 mm, densely strigillose or strigose to glabrous, acute to acuminate. Inflorescences congested-cymose, 1–1.5 × 1–1.5 cm, usually 5–10-flowered, densely hirtellous to strigose or strigillose, sessile or subsessile; bracts ovate to triangular or linear, 0.5–8 mm, situated at nodes, along axes, and usually in pairs and 0.5–2.5 mm immediately below flowers. Flowers sessile to shortly pedicellate, with pedicels to 1 mm. Calyx strigillose to pilosulous; ovary portion obconic, 0.5–1.5 mm; limb 2–2.5 mm, lobed for ca. 1/2 its length; lobes triangular to linear-lanceolate, acute. Corolla white or yellowish white, funnelliform to tubular, outside glabrous; tube 4–6 mm; lobes ovate, 1–2 mm. Berry globose, ca. 8 mm in diam., densely hirtellous or hispidulous to strigillose, with stipe or pedicel elongating above paired bracts, up to 12 mm; seeds reddish yellow, ca. 1.5 × 1–1.5 mm. Fl. Mar–Jun, fr. May–Mar.

Forests or thickets at streamsides in valleys; 400–2200 m. Xizang, Yunnan [Vietnam].

These varieties were recognized by W. C. Chen in FRPS (71(1): 362. 1999); some recently collected specimens seem to be intermediate but this species is poorly documented in general, so these are treated here at least for reference.

- 1a. Leaf blade adaxially smooth and glabrous or subglabrous, abaxially subglabrous or sparsely hirtellous or strigillose with pubescence denser along veins ..... 2a. var. *glabrescens*
- 1b. Leaf blade adaxially scaberulous and glabrous to sparsely hirtellous, strigillose, or hispidulous, abaxially densely grayish brown hirtellous to strigillose ..... 2b. var. *hirtellata*

**2a. *Brachytome hirtellata* var. *glabrescens*** W. C. Chen, Acta Phytotax. Sin. 22: 147. 1984.

疏毛短萼齿木 shu mao duan e chi mu

Leaf blade adaxially smooth and glabrous or subglabrous, abaxially subglabrous or sparsely hirtellous or strigillose with pubescence denser along veins. Fl. May–Jun, fr. Jun–Mar.

Forests at streamsides in valleys; 400–2200 m. Xizang (Mêdog), Yunnan [Vietnam].

**2b. *Brachytome hirtellata* var. *hirtellata***

滇短萼齿木(原变种) dian duan e chi mu (yuan bian zhong)

Leaf blade adaxially scaberulous and glabrous to sparsely hirtellous, strigillose, or hispidulous, abaxially densely grayish brown hirtellous to strigillose. Fl. Mar–Jun, fr. May–Dec.

• Forests or thickets at streamsides in valleys; 700–1600 m. Yunnan.

**3. *Brachytome wallichii*** J. D. Hooker, Hooker's Icon. Pl. 11: 70. 1871.

短萼齿木 duan e chi mu

Shrubs or small trees, 1.5–3 m tall; branches flattened to subterete, glabrous or sparsely strigillose or strigose becoming glabrescent with age. Petiole 0.3–1 cm, glabrous; leaf blade drying papery, green adaxially, often flushed with reddish brown abaxially, elliptic-oblong, lanceolate, or oblanceolate, 9–14 × 2.5–4.5 cm, glabrous on both surfaces, base cuneate to acute, apex acuminate; secondary veins 8–10 pairs; stipules triangular to narrowly triangular, 6–15 mm, glabrous to puberulent, acute to acuminate and sometimes falcate. Inflorescences 3–4 × 3–5 cm, several flowered, glabrous; peduncle ca. 0.5 cm; bracts triangular and often fused in pairs, 1–2 mm, usually situated at nodes and perhaps immediately below flowers; pedicels 5–10 mm. Calyx glabrous; ovary portion obconic, 1–1.5 mm; limb 1–1.5 mm, denticulate to lobed for up to 1/3 of its length; lobes broadly triangular. Corolla funnelliform, outside glabrous; tube ca. 6 mm; lobes triangular, ca. 1 mm, obtuse. Berry red, ellipsoid, 10–20 × 8–15 mm, with stipe or pedicel elongating, up to 20 mm; seeds 1–1.5 × 1–2 mm. Fr. Sep–Oct.

Forests in valleys; 1200–2000 m. SW Yunnan [Bangladesh, Cambodia, India, Myanmar, Vietnam].

This species was reported by W. C. Chen (in FRPS 71(1): 361. 1999) from Bhutan, but Springate et al. (Fl. Bhutan 2(2): 784. 1999) treated this as reported in error.

## 10. CAELOSPERMUM Blume, Bijdr. 994. 1826–1827.

穴果木属 xue guo mu shu

Chen Tao (陈涛); Charlotte M. Taylor

Lianas or sometimes shrubs or small trees, unarmed. Raphides present. Leaves opposite or rarely ternate, decussate on ascending branches but distichous on horizontal branches, with domatia; stipules persistent at least on apical 2 or 3 nodes and usually becoming hardened with age, at least shortly united around stem [or rarely interpetiolar], triangular and acute to truncate, sometimes shortly 2-toothed. Inflorescences terminal and sometimes in axils of uppermost leaves, corymbiform to panicleiform with flowers grouped in small heads or umbelliform cymes, many flowered, pedunculate, bracteate or bracts reduced. Flowers pedicellate to sessile, free [sometimes fused by their ovaries], bisexual, apparently monomorphic. Calyx with ovary portion usually hemispherical

or campanulate; limb tubular, truncate or 4–6-denticulate. Corolla white becoming yellowed when old, salverform or funnelliform, fleshy, variously pubescent inside; lobes 4 or 5 (or 6), valvate in bud. Stamens 4 or 5 (or 6), inserted in corolla tube, exerted; filaments developed; anthers dorsifixed near middle, 2-parted at base. Ovary 2-celled with ovules 2 in each cell or 4-celled via secondarily developing septa and ovules 1 in each cell, ovules inserted on middle of septum, anatropous or pendulous; stigmas 2, linear to spatulate, exerted or included. Fruit simple [sometimes multiple due to fusion of flowers], dark red to dark purple, drupaceous, fleshy, subglobose to ellipsoid, smooth, with calyx limb persistent; pyrenes 2, 3, or usually 4, 1-celled with 1 seed in each cell, ellipsoid to plano-convex, cartilaginous, densely puberulent; seeds medium-sized; endosperm oily; embryo straight.

Seven to ten species: from tropical Asia to Australia; one species in China.

This genus is similar and has long been considered related to *Morinda* and perhaps will be synonymized eventually, but it has provisionally been maintained by recent workers (Razafimandimbison et al., Molec. Phylogen. Evol. 48: 207–223. 2008). This genus was studied by Johansson (Blumea 3: 265–297. 1988), who synonymized the two species recognized by Y. Z. Ruan (in FRPS 71(2): 166–167. 1999) in China together with several other SE Asian names into a wide-ranging, morphologically variable species with the variation apparently continuous.

**1. *Caelospermum truncatum*** (Wallich) Baillon ex K. Schumann in Engler & Prantl, Nat. Pflanzenfam. 4(4): 136. 1891.

穴果木 xue guo mu

*Webera truncata* Wallich in Roxburgh, Fl. Ind. 2: 538. 1824; *Caelospermum kanehirae* Merrill; *C. morindiforme* Pierre ex Pitard; *C. scandens* Blume.

Lianas or weak shrubs, to 15 m high; branches weakly flattened to subterete or quadrangular, glabrous or glabrescent. Leaves opposite; petiole 10–25 mm, glabrous to puberulent; blade drying leathery or thickly papery and brownish yellow to pale black, elliptic, elliptic-oblong, lanceolate-oblong, ovate, or obovate, 7–15 × 3–10 cm, adaxially glabrous, abaxially paler and glabrous to puberulent, base cuneate to rounded, apex acute, obtuse, or rounded; secondary veins 4–7 pairs, with pilosulous domatia; stipules broadly triangular, 1–4.5 mm, truncate or 2-denticulate. Inflorescence a cymose panicle of 3–9

corymbs or umbels, 6–17 cm, mealy puberulent; peduncles 2.5–4 cm; umbels 3–20-flowered; bracts reduced. Flowers free, subsessile to pedicellate, pedicels to 6(–11) mm. Calyx mealy puberulent to glabrescent; ovary portion subglobose to cupuliform, 1–1.5 mm; limb 1–2 mm, truncate or 4- or 5-denticulate. Corolla salverform, outside glabrous to sparsely papillose; tube (4–)5–6(–9) mm, pubescent in upper part and throat; lobes linear to oblong-linear, (4.5–)5–6(–12) mm. Drupes subglobose, 8–12(–27) mm in diam. Fl. Apr–May, fr. Jul–Sep.

Thickets or sparse forests on hills or mountains; sea level to 1900 m. Guangxi, Hainan [Cambodia, Indonesia (Borneo, Java, Sumatra), Malaysia, Thailand, Vietnam].

Measurements in parentheses here come from Johansson's (Blumea 3: 265–297. 1988) description of this species throughout its range. He noted that the most widely used name for this species is *Caelospermum scandens*, here included as an aid to relating the Chinese species to the SE Asian flora.

## 11. *CANTHIUM* Lamarck, Encycl. 1: 602. 1785.

鱼骨木属 yu gu mu shu

Chen Tao (陈涛); Charlotte M. Taylor, Henrik Lantz

*Meyna* Roxburgh ex Link.

Shrubs or small trees, sometimes dioecious, sometimes with short shoots, unarmed or sometimes with paired straight supra-axillary thorns. Raphides absent. Leaves opposite, with or without domatia; stipules persistent or caducous, interpetiolar, shortly united around stem, or fused to petiole bases, triangular, internally (i.e., adaxially) sometimes sericeous to pilose. Inflorescences axillary, cymose to fasciculate, few to several flowered, sessile to pedunculate, bracteate with bracts sometimes fused in calyculate pairs. Flowers subsessile to pedicellate, bisexual and monomorphic (*Canthium* s.s.) or sometimes unisexual. Calyx with ovary portion often subglobose to hemispherical; limb very short, truncate or 4- or 5-lobed. Corolla green to white or pale yellow, tubular, urceolate, or funnelliform, with tube often constricted at top, inside variously pubescent but usually with ring of introrse hairs in tube; lobes 4 or 5, often long acuminate or aristate at apex, in bud valvate and often with apices held erect and pressed together forming apiculate projection, at anthesis notably reflexed. Stamens 4 or 5, inserted at corolla throat, partially to fully exerted; filaments short or reduced; anthers dorsifixed near base, elliptic to ovate, at anthesis reflexed. Ovary 2–5-celled, ovules 1 in each cell, pendulous from apical placenta; stigma included or exerted, capitate to cupular, entire to variously lobed, usually with style attachment recessed. Fruit brown, yellow, orange, or red, drupaceous, subglobose, ellipsoid, or often dicoccos when fully developed or reniform with only 1 seed, fleshy, with calyx limb caducous or infrequently persistent; pyrenes 2–5, 1-celled with 1 seed in each cell, ellipsoid to reniform, bony or crustaceous; seeds medium-sized to large, ellipsoid, cylindrical, or plano-convex; testa membranous; endosperm fleshy; radicle ascending.

About 30 species: tropical and subtropical Africa and Asia; four species (one endemic) in China.

The circumscription and separation of genera of Vanguerieae and especially *Canthium*, *Meyna*, *Psydrax*, *Pyrostria* Commerson ex Jussieu, *Vangueria* Jussieu, and their closely related genera are problematic, controversial, and far from a full resolution. Lantz and Bremer (Bot. J. Linn. Soc. 146: 257–283. 2004) provided revised circumscriptions of several genera; in particular, they synonymized *Meyna* with *Canthium* and moved some species from *Canthium* to *Psydrax*. The Asian lineages have not yet been studied deeply, and the Chinese species may yet be reclassified.

The name *Canthium cavalieriei* H. Léveillé (Repert. Spec. Nov. Regni Veg. 10: 434. 1912) is based on a specimen from Guizhou; this name was not treated in FRPS. As the specimen has not been seen and its description is scanty, its identity is unknown. It has been suggested to be related to *Lasianthus*, but according to Lauener and Ferguson (Notes Roy. Bot. Gard. Edinburgh 32: 103. 1972) that is incorrect.

- 1a. Plants unarmed or usually armed with thorns; flowers borne in fascicles on peduncles 1–2 mm ..... 3. *C. horridum*  
 1b. Plants without thorns; flowers borne in fascicles on peduncles 4–8 mm, or in cymes with peduncles 8–25 mm and pedicels 2–8 mm.  
 2a. Leaves 9–19 × 4–8.5 cm; inflorescences corymbiform to cymose, 2.5–3 × ca. 2 cm in flower, to 7 × 9 cm in fruit; fruit 10–20 × 9–15 mm ..... 4. *C. simile*  
 2b. Leaves 3–9 × 1.5–5 cm; inflorescences fasciculate to subumbelliform, 1–3.5 cm in flower and fruit; fruit 8–10 mm in diam.  
 3a. Flowers unisexual on dioecious plants; secondary leaf veins 3 or 4 pairs; stipules persistent; corolla tube ca. 1.5 mm and lobes 2–6 mm; ovary locules and pyrenes 2 ..... 1. *C. gynochthodes*  
 3b. Flower bisexual; secondary leaf veins 5 or 6 pairs; stipules caducous; corolla tube ca. 3 mm and lobes ca. 3 mm; ovary locules and pyrenes 3 or 4 ..... 2. *C. hainanense*

**1. *Canthium gynochthodes* Baillon, Adansonia 12: 199. 1878.**

朴菜木 po lai mu

*Canthium cumingii* Vidal; *Plectronia cumingii* (Vidal) Merrill; *P. gynochthodes* (Baillon) Merrill; *P. moluccana* Merrill; *P. umbellata* K. Schumann.

Small trees, height not noted, often rather succulent; branches flattened becoming subterete, glabrous. Petiole 1–5 mm, glabrous; leaf blade drying thinly leathery, elliptic to elliptic-oblong or obovate, 3–8 × 1.5–5 cm, glabrous on both surfaces, base acute to obtuse, apex obtuse to shortly acute; secondary veins 3 or 4 pairs, in abaxial axils with foveolate and sometimes also pilosulous domatia; stipules persistent, shortly united around stem, triangular to ovate, 2–4.5 mm, glabrous, aristate to cuspidate. Inflorescences glabrous, 1–3.5 cm, several flowered; peduncles 0.8–2.5 cm, terminating in a pair of bracteoles, these triangular, ca. 1 mm, shortly fused; pedicels 4–7 mm. Flowers unisexual on dioecious plants. Calyx glabrous; ovary portion of pistillate flowers ca. 1.2 mm; limb ca. 0.5 mm, truncate to undulate. Corolla white to pale green, outside glabrous; tube ca. 1.5 mm; lobes 4, 2–2.5(–6) mm, acute. Ovary 2-celled; stigma ca. 0.3 mm. Drupes orangish yellow, obovate or obovoid to dicocous, ca. 8 × 10 mm, smooth, glabrous, with calyx limb persistent; pyrenes 2. Fl. Aug.

Forests on mountain ridges. Taiwan [Philippines].

Only very young flower buds have been seen so far from China; the descriptions here of the mature flowers and the fruit are based in large part on the description by Liu and Yang (Fl. Taiwan, ed. 2, 4: 247–248. 1998) and on Philippine specimens. The synonymy here is taken from Merrill (Enum. Philipp. Pl. 3: 536–537. 1923). The accepted species epithet was incorrectly spelled as “*gynochodes*” by Liu and Yang (loc. cit.: 247).

*Canthium dicocum* var. *obovatifolium* should probably be compared with this species. The variety is poorly known and is here included with the species in which it was described, now called *Psydrax dicocca*; but its inclusion in that species is questionable, and its description suggests it is very similar to *C. gynochthodes*.

**2. *Canthium hainanense* (Merrill) Lantz, comb. nov.**

琼梅 qiong mei

Basionym: *Meyna hainanensis* Merrill, Lingnan Sci. J. 14: 57. 1935.

Small trees, 3–6 m tall; branches weakly flattened to subterete, glabrous or puberulent, at nodes with stipule bases together with bases of petioles usually markedly thickened with thickened portion sometimes tardily splitting interpetiolarly, usually with stout lateral short shoots 0.5–1 cm, these densely covered with scalelike old stipule bases. Leaves borne at nodes near apex of developed stems or clustered on short shoots; petiole 5–8 mm, glabrous, sometimes weakly articulate near base; blade drying papery or thinly papery, ovate, oblong-ovate, or elliptic-oblong, 3–9 × 1.5–5 cm, adaxially glabrous or rarely strigillose, abaxially strigillose or strigose, base obtuse to rounded, apex acute or acuminate; secondary veins 5 or 6 pairs, in abaxial axils with pilosulous domatia; stipules shortly united around stem with basal portion persistent becoming thickened and upper portion caducous, triangular to lanceolate, 2–5 mm, often keeled, acuminate to aristate. Inflorescences fasciculate to subumbelliform and subsessile, 1–1.5 cm, few to several flowered, puberulent or hirtellous to glabrescent; peduncles 4–8 mm; bracts reduced. Calyx puberulent; ovary portion obconic, ca. 0.5 mm; limb with lobes (4 or)5, triangular, 0.5–0.8 mm, acute. Corolla color not noted, funnellform, outside glabrous; tube ca. 3 mm, inside pubescent in upper half; lobes (4 or)5, lanceolate to spatulate-triangular, ca. 3 mm, acute to acuminate. Ovary 3- or 4-celled; stigma ca. 0.8 mm. Drupes with color not noted, subglobose, 8–10 mm in diam., puberulent to glabrescent, with calyx limb persistent; pyrenes 3 or 4. Fl. Apr–Aug, fr. Jun.

- Broad-leaved forests; 200–300 m. Hainan.

The illustration of this species presented by W. C. Ko (in FRPS 71(2): 8, t. 3. 1999) shows four calyx lobes and four corolla lobes; however, these structures both were described as five in the protologue, and the specimens seen have five calyx lobes.

**3. *Canthium horridum* Blume, Catalogus, 45. 1823.**

猪肚木 zhu du mu

*Canthium hebecladum* Candolle; *C. pauciflorum* Blanco; *Plectronia horrida* (Blume) Benth & J. D. Hooker.

Shrubs, 2–3 m tall; branches flattened to subterete, often rather slender, strigillose to strigose or pilosulous, sometimes with lateral short shoots to 0.5 cm; thorns slender to stout, 3–30 mm, straight, or sometimes absent. Leaves paired along developed stems or sometimes clustered on lateral short shoots;

petiole 2–3 mm, strigillose to pilosulous; blade drying papery, ovate to lanceolate or elliptic, 2–6 × 1–3.5 cm, adaxially glabrous or strigillose to hispidulous along principal veins or throughout, abaxially puberulent to strigillose or hispidulous, base rounded or obtuse, apex obtuse, acute, or weakly acuminate; secondary veins 2 or 3 pairs, in abaxial axils with pilosulous and/or foveolate domatia; stipules deciduous after distalmost several nodes, triangular to ovate, 2–3 mm, densely strigillose to strigose, acute. Inflorescences fasciculate, 0.5–1 cm, few flowered, strigillose to glabrescent; peduncles 1–3 mm, each with a pair of triangular bracteoles ca. 1 mm and fused in pairs. Calyx puberulent to glabrous; ovary portion obconic, ca. 0.8 mm; limb 0.5–0.8 mm, truncate to undulate. Corolla white, funnellform, outside glabrous; tube suburceolate, ca. 2 mm; lobes 5, triangular-oblong, ca. 3 mm, acuminate. Ovary 2-locular; stigma ca. 0.5 mm. Drupes yellow, ovoid to subglobose, obovoid, or somewhat dicocous, laterally somewhat flattened, 15–25 × 10–20 mm, smooth, glabrous, with calyx limb persistent; pyrenes 2, weakly tuberculate. Fl. Apr–Jun, fr. Jul–Nov.

Thickets at low elevations; near sea level to 500 m. Guangdong, Guangxi, Hainan, Yunnan [India, Malaysia, Thailand, Vietnam].

The name *Canthium parvifolium* Roxburgh has sometimes been applied to the Chinese plants that are here called *C. horridum*. W. C. Ko (in FRPS 71(2): 10. 1999) considered it a misapplied name, listing it as "*Canthium parvifolium* auct. non Roxb."

#### 4. *Canthium simile* Merrill & Chun, Sunyatsenia 2: 19. 1934.

大叶鱼骨木 da ye yu gu mu

Erect shrubs to small trees, 4–10(–18) m tall, unarmed;

branches glabrous, somewhat compressed becoming terete. Leaves borne along developed stems; petiole 5–8 mm, glabrous; blade drying thinly to thickly papery, ovate to ovate-oblong or elliptic-oblong, 9–19 × 4–8.5 cm, adaxially shiny and glabrous or sometimes pustulose, abaxially glabrous to pilosulous or pilose, base obtuse to rounded, apex shortly acuminate; secondary veins 6–8 pairs, in abaxial axils with small foveolate domatia; stipules deciduous, shortly united around stem, triangular, 2–8 mm, sparsely pilosulous to glabrous, keeled, cuspidate to acuminate. Inflorescences corymbiform to cymose, 2.5–3 × ca. 2 cm, several flowered, puberulent to hirtellous; peduncle 10–14 mm; bracts reduced; pedicels 2–3 mm. Calyx puberulent to glabrous; ovary portion obconic to hemispherical, 1–1.5 mm; limb ca. 0.5 mm, 5-lobed; lobes broadly ovate-triangular, acute. Corolla white, urceolate-tubular, outside glabrous; tube 1.5–2 mm, inside villous in throat; lobes 5, triangular to spatulate, 1.5–3 mm, acute. Ovary 2-locular; stigma ca. 1.2 mm. Infructescences expanded, to 7 × 9 cm; fruiting pedicels to 12 mm. Drupes with color not noted, obovoid, laterally compressed, often somewhat dicocous, 10–20 × 9–15 mm, glabrescent, with calyx limb deciduous; pyrenes 2, plano-convex. Fl. Jan–Mar, fr. Jun–Jul.

Broad-leaved forests at low to middle elevations; 200–1500 m. Guangdong, Guangxi, Hainan, Yunnan [Vietnam].

This species is newly reported here from Vietnam, based on *Thorel 1294* (GH).

The measurements of the flower parts given by Merrill and Chun in the protologue do not agree with the measurements inferred from their figure 2; their figure seems to have been reproduced at twice the size they planned.

## 12. CATUNAREGAM Wolf, Gen. Pl. 75. 1776.

山石榴属 shan shi liu shu

Chen Tao (陈涛); Charlotte M. Taylor

*Xeromphis* Rafinesque.

Shrubs or small trees, often with short shoots, often armed with spines or spinescent short shoots. Raphides absent. Leaves opposite or often clustered and apparently fasciculate on short shoots, subsessile to petiolate, usually with domatia; stipules deciduous or caducous, interpetiolar, triangular. Inflorescences terminal on short shoots or these sometimes reduced giving an appearance of axillary position, 1-flowered, or cymose to fasciculate and 2–6-flowered, sessile to pedunculate, bracteate or bracts reduced. Flowers subsessile to pedicellate, bisexual, monomorphic. Calyx limb deeply 5-lobed, lobes spatulate to obovoid. Corolla white to cream or pale green, campanulate to subrotate, usually densely sericeous outside, variously pubescent inside; lobes 5[–10], convolute in bud. Stamens 5, inserted in corolla throat, partially to fully exerted; filaments short; anthers dorsifixed. Ovary 2-celled, ovules many in each cell on axile placentas attached at center of septum; stigma ellipsoid or 2-lobed, exerted. Fruit generally yellowish brown, baccate, leathery to thickly fleshy or infrequently hard, globose, ellipsoid, or ovoid-globose, with calyx limb persistent; seeds numerous, medium-sized, ellipsoid, angled, or reniform, embedded in fleshy or mucilaginous pulp.

About five to perhaps ten species: widespread in Africa, also in Bhutan, China, Cambodia, India, Indonesia, Kashmir, Laos, Madagascar, Malaysia, Myanmar, Nepal, Pakistan, Sri Lanka, Thailand, Vietnam; one species in China.

The calyx limb enlarges markedly during the development of the fruit. At least some species of *Catunaregam* in Africa have nocturnal sweetly fragrant flowers (Bridson & Verdcourt, Fl. Trop. E. Africa, Rub. (Pt. 2), 496–500. 1988), and *Catunaregam* in China may also. Many species of related genera also have secondary pollen presentation, and these features may be present in *Catunaregam* also.

#### 1. *Catunaregam spinosa* (Thunberg) Tirvengadam, Bull. Mus. Natl. Hist. Nat., Sér. 3, Bot. 35: 13. 1978.

山石榴 shan shi liu

*Gardenia spinosa* Thunberg, *Gardenia*, 16. 1780; *G. dumetorum* Retzius; *Randia dumetorum* (Retzius) Lamarck; *Randia spinosa* (Thunberg) Poiret; *Xeromphis retzii* Rafinesque; *X. spinosa* (Thunberg) Keay.

Shrubs or small trees, 1–10 m tall; branches rather stout, hirsute, pilose, pilosulous, or puberulent to glabrescent, armed with axillary stout paired thorns 1–5 cm. Petiole 2–8 mm, pilose, pilosulous, or hirtellous to glabrous; leaf blade drying papery or subleathery, obovate or oblong-obovate or rarely ovate to spatulate, 1.8–11 × 1–5.7 cm, both surfaces glabrous to strigillose, strigose, hirtellous, or sparsely hirsute at least along principal veins, base cuneate and sometimes decurrent, margins entire or often shortly ciliate, apex acute; secondary veins 4–7 pairs, often with pilosulous domatia in abaxial axils; stipules caducous, ovate to broadly triangular, 3–4.5 mm, acute to aristate. Inflorescences terminal on lateral short shoots together with tufted leaves, 1–3-flowered; pedicels 2–5 mm, brown villous or -hirtellous. Calyx brown villous, -hirtellous, or -strigose; ovary portion ovoid to ellipsoid, 3.5–7 × 4–5.5 mm; limb slightly dilated, deeply lobed; lobes broadly elliptic to oblan-

ceolate or obovoid, 5–8 × 3–6 mm, acute to rounded. Corolla white, becoming pale yellow with age, campanulate; tube 5–6 mm, sparsely villous in throat; lobes ovate or ovate-oblong, 6–11 × (5.5–)8–9 mm, spreading, rounded to subtruncate. Anthers ca. 3 mm, fully exserted. Style 4–6 mm; stigma fusiform, with 2 coherent lobes, ca. 2 mm. Berry globose, 2–4 cm in diam., glabrous or sparsely pilose or strigose; seeds 4–5 mm. Fl. Mar–Jun, fr. May–Jan.

Thickets or forests at streamsides, on hills or mountain slopes, or in valleys or fields; near sea level to 1600 m. Fujian, Guangdong, Guangxi, Hainan, Taiwan, Yunnan [Cambodia, India, Indonesia, Kashmir, Laos, Malaysia, Myanmar, Nepal, Pakistan, Sri Lanka, Thailand, Vietnam; Africa, Madagascar].

W. C. Chen (in FRPS 71(1): 338–340. 1999) noted that this species is sometimes climbing, but this has not been noted by any other authors nor seen on specimens.

### 13. CEPHALANTHUS Linnaeus, Sp. Pl. 1: 95. 1753.

风箱树属 feng xiang shu shu

Chen Tao (陈涛); Charlotte M. Taylor

Shrubs or trees, unarmed; buds conical. Raphides absent. Leaves verticillate or opposite, distichous, usually with domatia; stipules persistent [or sometimes caducous], interpetiolar, triangular, at apex sometimes with a black gland. Inflorescences terminal and sometimes in axils of uppermost leaves, capitate with several globose heads, many flowered, pedunculate, bracteate; bracteoles clavate to clavate-spatulate. Flowers sessile, bisexual, monomorphic. Calyx limb 4(or 5)-lobed. Corolla white to cream, salverform to funnellform, variously pubescent inside; lobes 4, imbricate (and quincuncial) in bud. Stamens 4, inserted in corolla throat, partially exserted; filaments short; anthers dorsifixed, bifid at base. Ovary 2-celled, ovules 1 in each cell, apical and pendulous, anatropous; stigma clavate to capitate, exserted. Fruiting heads globose. Fruit schizocarpous, obconic to turbinate, dry, with calyx limb persistent; mericarps 2, indehiscent, with 1 seed, obconic, stiffly papery; seeds medium-sized, oblong-ellipsoid, with white spongy aril.

Six species: three in the Americas, two in Asia, one in Africa; one species in China.

**1. *Cephalanthus tetrandrus* (Roxburgh) Ridsdale & Bakhuizen f., Blumea 23: 182. 1976 [“*tetrandra*”].**

风箱树 feng xiang shu shu

*Nauclea tetrandra* Roxburgh, Fl. Ind. 2: 125. 1824; *Cephalanthus glabrifolius* Hayata; *C. naucleoides* Candolle; *C. ratoensis* Hayata.

Deciduous shrubs or small trees, 1–5 m tall; branches subangled to terete, densely pilosulous or tomentulose to usually glabrous. Leaves opposite or in whorls of 3–5, with number often irregular on a stem; petiole 5–10 mm, densely tomentulose or pilosulous to usually glabrous; blade drying stiffly papery to subleathery, ovate to ovate-lanceolate, elliptic, or elliptic-oblong, 6.5–15 × 3–6 cm, adaxially glabrous to sparsely puberulent and often rugulose, abaxially densely pilosulous to usually glabrous, base obtuse, rounded, or subcordate, apex acute to acuminate; secondary veins 8–12 pairs, often with pilosulous domatia in axils or along costa; stipules persistent or often deciduous leaving a persistent truncate basal portion, broadly ovate, 3–5 mm, adaxially enclosing a ring of persistent white trichomes 0.5–1 mm, abaxially glabrous to occasionally densely pilosulous, apex cuspidate, often with a black terminal gland. Inflorescence densely tomentulose or pilosulous to usu-

ally glabrous; peduncles 2.5–6 cm; flowering heads 1–10, 8–12 mm in diam. across calyces, 20–25 mm in diam. across corollas; bracteoles linear-clavate, ca. 2 mm, strigose. Calyx with ovary portion obconic, ca. 1 mm, glabrous, surrounded at base by ring of pilose trichomes; limb with tubular portion 1–2 mm, glabrous to sparsely puberulent; lobes spatulate-oblong, 1–2 mm, densely puberulent, obtuse to rounded, in sinuses usually with stipitate or sessile black gland. Corolla outside glabrous; tube 7–12 mm, pubescent inside; lobes spatulate-oblong, 1–2 mm, obtuse or rounded, in sinuses often with stipitate black gland. Stigma ellipsoid or clavate, ca. 0.5 mm, exserted by 4–6 mm. Fruiting head 10–20 mm in diam. Mericarps 4–6 mm, glabrous; seeds brown, 3–5 mm. Fl. Jun–Sep, fr. Jul–Sep.

Shady sites at roadsides or streamsides; sea level to 700 m. Fujian, Guangdong, Guangxi, Hainan, Hunan, Jiangxi, Taiwan, Yunnan, Zhejiang [Bangladesh, India, Laos, Myanmar, Thailand, Vietnam].

This species was long considered conspecific with *Cephalanthus occidentalis* Linnaeus of North America; consequently, that name has been frequently but erroneously used for the Asian plants. Ridsdale (Blumea 23: 177–188. 1976) concluded that only one species of *Cephalanthus* is found in Asia and it is distinct from the North American species. Ridsdale (loc. cit.: 180–181) reported that this species is tolerant of wet soils and sometimes cultivated for ground stabilization.

**14. CERISCOIDES** (Bentham & J. D. Hooker) Tirvengadam, Bull. Mus. Natl. Hist. Nat., Sér. 3, Bot. 35: 13. 1978.

木瓜榄属 mu gua lan shu

Chen Tao (陈涛); Charlotte M. Taylor

*Gardenia* sect. *Ceriscoides* Bentham & J. D. Hooker, Gen. Pl. 2: 90. 1873.

Shrubs or small trees, dioecious [or polygamo-dioecious], often with short shoots, unarmed or with spines or spinescent short shoots. Raphides absent. Leaves opposite but usually crowded on short shoots and apparently fasciculate, sometimes with domatia; stipules caducous, interpetiolar, triangular. Inflorescences terminal on lateral branches or short shoots [sometimes cauliflorous], sessile to pedunculate, bracteate, staminate 2-flowered or 2- or 3-flowered and cymose, pistillate 1-flowered. Flowers sessile to pedicellate, unisexual [sometimes bisexual and monomorphic]. Calyx with ovary portion hemispherical to ellipsoid in pistillate flowers, markedly turbinate with base narrowed in staminate flowers; limb subtruncate to 5(-7)-lobed. Corolla white to pale green, tubular-campanulate or funnellform, glabrous inside; lobes 5(-7), convolute in bud. Stamens 5(-7), inserted in corolla throat, included, staminodes markedly reduced; filaments short; anthers dorsifixed. Ovary 1-celled, ovules numerous in each cell on 2-4[-6] parietal placentas; stigmas 2[-6]-lobed, included. Fruit brown, baccate, fleshy, globose to ellipsoid, smooth, with calyx limb persistent; seeds numerous, large, ellipsoid to lenticular, embedded in fleshy pulp.

About 11 species: China, India, Indonesia, Laos, Malaysia, Myanmar, Philippines, Sri Lanka, Thailand, Vietnam; one species (endemic) in China.

*Ceriscoides* was recently studied by Azmi (Harvard Pap. Bot. 7(2): 443-464. 2003). H. S. Lo (in FRPS 71(1): 337. 1999) described the placentas as 2-4 and the stigmas of our species as 2, but Azmi (loc. cit.: 445) described both of these as 3-6.

**1. *Ceriscoides howii*** H. S. Lo, Bull. Bot. Res., Harbin 18: 281. 1998.

木瓜榄 mu gua lan

Shrubs, 3-4 m tall; branches angled, pale red or pale yellow, often stout, armed with spines 2.5-4 mm. Petiole 2-5 mm, glabrous; leaf blade drying olive-green and abaxially paler, narrowly elliptic or oblong-lanceolate, 5-11 × 1.5-4 cm, both surfaces glabrous, base obtuse to acute or rarely subrounded, apex acuminate to slightly obtuse; secondary veins 5 or 6 pairs, with pilosulous domatia in abaxial axils; stipules triangular, ca. 2

mm. Inflorescences glabrescent; bracteoles squamiform, erose. Flowers subsessile. Calyx glabrous; limb ca. 4.5 mm, subtruncate or 5-denticulate. Corolla pale yellow, tubular-campanulate to tubular-funnelform, glabrous outside; tube at base ca. 3 mm in diam., in throat 6-7 mm in diam., glabrous inside, in staminate flower 10-11.5 mm, in pistillate flower 13-13.5 mm; lobes 5, suborbicular, 3.5-4 mm, obtuse. Style stout, 5-6 mm. Berry brown, ovoid to subglobose, 3.5-4.5 cm, glabrous, smooth; seeds dark brown, oblong or ellipsoid, 8-10 mm, rather shiny. Fl. Oct, fr. Apr of following year.

• Forests in valleys; 400-500 m. Hainan.

**15. CHASSALIA** Commerson ex Poirlet in Lamarck, Encycl. Suppl. 2: 450. 1812.

弯管花属 wan guan hua shu

Chen Tao (陈涛); Charlotte M. Taylor

Shrubs, subshrubs, or small trees, unarmed. Raphides present. Leaves opposite or in whorls of 3, sometimes with domatia; stipules persistent or sometimes with top portion deciduous, interpetiolar or united around stem, triangular to bifid, sometimes with basal portion becoming hardened, sometimes glandular at apex or on short appendages. Inflorescence terminal, thyriform to cymose, many flowered, sessile to pedunculate, bracteate. Flowers sessile or pedicellate, bisexual, usually distylous. Calyx limb 5-lobed [to truncate or denticulate]. Corolla white to pink or pale yellow, tubular to funnellform, with tube often curved, variously glabrous or pubescent inside; lobes 5, valvate in bud. Stamens 5, inserted in corolla tube, included or exerted; filaments short or absent; anthers dorsifixed. Ovary 2-celled, ovules 1 in each cell, basal; stigmas 2, linear, included or exerted. Infructescence frequently becoming purple with axes swollen and jointed. Fruit purple to black, drupaceous, fleshy, ellipsoid, subglobose, or ovoid, with calyx limb persistent; pyrenes 2, plano-convex, 1-celled, each with 1 seed, smooth on dorsal surface, on ventral surface with a large concave excavation; seeds medium-sized, compressed orbicular; endosperm fleshy; radicle cylindrical, basiscopic.

About 40 species: widespread in tropical Africa, Asia, and Madagascar, and the Mascarene Islands; one species in China.

**1. *Chassalia curviflora*** (Wallich) Thwaites, Enum. Pl. Zeyl. 150. 1859.

弯管花 wan guan hua

Subshrubs, erect, 1-2 m tall; branches weakly flattened to subterete, glabrous or rarely sparsely puberulent. Leaves oppo-

site; petiole 1-4 cm, glabrous; blade drying membranous to thinly papery and often yellowish green, oblong-elliptic, elliptic, oblanceolate, or narrowly lanceolate, 6-27 × 1.5-7.5 cm, glabrous, base cuneate to attenuate, apex acuminate to long acuminate; secondary veins 8-17 pairs, without domatia; stipules persistent, united shortly around stem, with interpetiolar portion

broadly ovate or broadly triangular, 1.5–4.5 mm, acute or obtuse, entire or usually shortly bifid, with 1 or 2 bristles 0.3–1 mm, often gland-tipped. Inflorescence cymose, pyramidal to rounded, several to many flowered, puberulent; peduncle 1–5 cm; branched portion 3–7 cm; axes weakly flattened; bracts lanceolate to triangular or usually multifid, 0.5–3 mm. Flowers subsessile, trimorphic: with anthers exserted and stigmas included, with anthers included and stigmas exserted, or with anthers and stigmas both exserted. Calyx with hypanthium portion ellipsoid to obovoid, 1–1.5 mm, glabrous; limb 5-lobed, 0.5–1 mm; lobes 0.3–0.5 mm, acute. Corolla white with pink, red, or orange on lobes, outside glabrous to sparsely puberulent and longitudinally ridged to winged along tube then midribs of lobes; tube shallowly to markedly curved, straight or bent at base, 10–15 mm, pubescent inside; lobes (4 or)5, ovate-triangular, 2–2.5 mm, at apex thickened. Infructescence axes becoming swollen and red. Fruit purple, oblate to globose or weakly didymous, 5–7 × 6–9 mm. Fl. Apr–Jun, fr. Apr–Jan.

Wet places, forest understories, at low elevations; 100–2000 m. Guangdong, Guangxi, Hainan, Xizang, Yunnan [Bangladesh, Bhutan, Borneo, Cambodia, E and NE India (including Andaman Islands), Indonesia, Malaysia, Philippines, Singapore, Sri Lanka, Thailand, Vietnam].

At anthesis the corolla tube curves upward so that the base of the tube is suberect, the middle portion of the tube arcs toward the horizontal, and the mouth of the corolla opens outward to the side (Puff et al., Rubiaceae of Thailand, 101. 2005). Other authors have found this species distylous with the flowers 5-merous or infrequently 4-merous on aberrant individual flowers, as in many Rubiaceae; H. S. Lo (in FRPS 71(2): 61. 1999) described it as tristylous with often 4 corolla lobes.

- 1a. Leaves oblong-elliptic, elliptic, or oblanceolate, 6–27 × 2.5–7.5 cm, with secondary veins distinct on adaxial surface ..... 1a. var. *curviflora*

- 1b. Leaves narrowly lanceolate, 13–27 × 1.5–4.5 cm, with secondary veins distinct to indistinct on adaxial surface ..... 1b. var. *longifolia*

**1a. *Chassalia curviflora* var. *curviflora***

弯管花(原变种) wan guan hua (yuan bian zhong)

*Psychotria curviflora* Wallich in Roxburgh, Fl. Ind. 2: 167. 1824.

Leaves oblong-elliptic, elliptic, or oblanceolate, 6–27 × 2.5–7.5 cm; secondary veins distinct on adaxial surface. Fl. Apr–Jun, fr. Apr–Jan.

Wet places, forest understories; 100–2000 m. Guangdong, Guangxi, Hainan, Xizang, Yunnan [Bangladesh, Bhutan, Borneo, Cambodia, E and NE India (including Andaman Islands), Indonesia, Malaysia, Philippines, Singapore, Sri Lanka, Thailand, Vietnam].

**1b. *Chassalia curviflora* var. *longifolia* J. D. Hooker, Fl. Brit. India 3: 177. 1880.**

尖叶弯管花 jian ye wan guan hua

*Psychotria longifolia* Dalzell, Hooker's J. Bot. Kew Gard. Misc. 2: 133. 1850, not Hoffmannsegg ex Roemer & Schultes (1819), nor Sprengel (1824); *Chassalia longifolia* K. M. Wong.

Leaves narrowly lanceolate, 13–27 × 1.5–4.5 cm; secondary veins distinct or often indistinct on adaxial surface. Fl. May, fr. Jul.

Wet places, forest understories; 100–2000 m. Guangdong, Guangxi, Hainan, Xizang, Yunnan [Bangladesh, Bhutan, Borneo, Cambodia, E and NE India (including Andaman Islands), Indonesia, Malaysia, Philippines, Singapore, Sri Lanka, Thailand, Vietnam].

Plants that match this variety are uncommonly collected and are provisionally separated here.

**16. CINCHONA Linnaeus, Sp. Pl. 1: 172. 1753.**

金鸡纳属 jin ji na shu

Chen Tao (陈涛); Charlotte M. Taylor

*Kinkina* Adanson; *Quinquina* Boehmer.

Shrubs or usually trees, unarmed; buds flattened with stipules erect and pressed together; bark usually notably bitter. Raphides absent. Leaves opposite, decussate, usually with well-developed domatia; stipules caducous, interpetiolar or shortly united around stem, ligulate to obovate, entire. Inflorescences terminal and often also in axils of uppermost leaves, cymose to paniculiform, many flowered, pedunculate, bracteate. Flowers pedicellate, bisexual, fragrant, usually distylous. Calyx limb 5-lobed. Corolla yellow, pink, purple, red, or occasionally white, salverform or funnellform, inside glabrous or pubescent in throat, with tube often weakly 5-ridged outside; lobes 5, valvate in bud, with margins densely ciliate to villous. Stamens 5, inserted in corolla tube, included to partially exserted; filaments short to developed, glabrous; anthers dorsifixed. Ovary 2-celled, ovules many in each cell on axile placentas; stigma 2-lobed, lobes capitate to linear. Fruit capsular, ovoid to cylindrical or ellipsoid, septically dehiscent into 2 valves from base or sometimes from apex with valves then loculicidal through septum, stiffly papery to woody, often lenticellate, with calyx limb persistent; seeds numerous, medium-sized, ellipsoid to fusiform and somewhat flattened with membranous marginal wing and elliptic central seed portion; endosperm fleshy; cotyledons ovate.

Twenty-three species: Central America (Costa Rica, Panama) and South America (Bolivia, Colombia, Ecuador, Peru, Venezuela) and cultivated as species and hybrids in tropical regions worldwide; two species (both introduced) in China.

Several species of *Cinchona* are the natural source of quinine, which has long been used worldwide as a treatment for malaria. Quinine is found along with several other alkaloids in high concentrations in some species of *Cinchona*, particularly the bark; these alkaloids give the plants their bitter taste. *Cinchona* is native to South America, where its species are not all well differentiated, are morphologically variable, and hybridize freely especially in cultivation, where numerous artificial hybrids have been created. *Cinchona* was recently monographed by Andersson (Mem. New York Bot. Gard. 80: 1–75. 1998), followed here, who clarified the identities of the commonly cultivated species.

*Cinchona officinalis* (Linnaeus, Sp. Pl. 1: 172. 1753; 正鸡纳树 zheng ji na shu) is native to South America (Ecuador) and perhaps occasionally cultivated in tropical regions worldwide. No confirmed documentation of this species has been seen from China. The name has long been incorrectly used in cultivation for plants treated here as *Cinchona calisaya* (Andersson, loc. cit.: 55–57). It is included for reference in the key to species.

- 1a. Leaf blade usually relatively broad, ovate, ovate-elliptic, or elliptic-oblong, 5.5–17 cm wide, abaxially moderately to densely hirtellous at least when young and with pilosulous domatia but without crypt domatia in axils of veins ..... 2. *C. pubescens*
- 1b. Leaf blade usually of average or relatively narrow width, lanceolate, oblong-lanceolate, elliptic, obovate-lanceolate, or elliptic-oblong, 2–11 cm wide, abaxially glabrous or puberulent to hirtellous and with or without crypt domatia.
- 2a. Leaf blade without crypt domatia ..... *C. officinalis* (see comment above)
- 2b. Leaf blade with crypt domatia.
- 3a. Leaves with domatia best developed in proximal part of blade; calyx lobes comprising more than 1/2 length of calyx limb; capsules stiffly papery to woody ..... 1. *C. calisaya*
- 3b. Leaves with domatia best developed in distal part of blade; calyx lobes comprising less than or up to ca. 1/2 length of calyx limb; capsules stiffly papery ..... *C. officinalis* (see comment above)

**1. *Cinchona calisaya*** Weddell, Ann. Sci. Nat., Bot., sér. 3, 10: 6. 1848.

金鸡纳树 jin ji na shu

*Cinchona calisaya* var. *ledgeriana* Howard; *C. ledgeriana* (Howard) Bernelot Moens ex Trimen; *Quinquina calisaya* (Weddell) Kuntze; *Q. ledgeriana* (Howard) Kuntze.

Trees or shrubs, to 15(–25) m tall; bark grayish brown, thin, with many shallow fissures; branches flattened to sub-quadrangular, puberulent to hirtellous or glabrescent. Petiole 3–20(–30) mm, glabrous or hirtellous or puberulent; leaf blade drying papery or thinly leathery, oblong-lanceolate, elliptic-oblong, or lanceolate, 7–16(–21.5) × 2.5–6(–11) cm, both surfaces glabrous or sparsely puberulent to hirtellous abaxially, base acute to cuneate, apex obtuse to rounded or rarely acute; secondary veins 7–11 pairs, usually with crypt domatia, these best developed in proximal part of blade; stipules 10–20 mm, glabrous to puberulent or hirtellous, obtuse to rounded. Inflorescences 5–23 × 5–18 cm, densely hirtellous to puberulent; bracts triangular, 0.5–3 mm; pedicels 1–8 mm. Calyx densely sericeous; ovary portion ellipsoid, 1.5–2 mm; limb 1–2 mm, sparsely puberulent, partially lobed; lobes ovate-triangular, 0.5–1 mm. Corolla white, pale yellow, or pale pink, glabrous to puberulent outside; tube cylindrical, 5–9 mm, glabrous inside; lobes lanceolate, 3–4(–6) mm, acute. Capsules 8–30 × 3–8 mm, stiffly papery to woody, puberulent or pilosulous to glabrescent; seeds 3–10 × 1.6–3.7 mm (including wing). Fl. Jun–Feb.

Cultivated. Hainan, Taiwan, S Yunnan [native to South America (Bolivia, Peru); cultivated in tropical regions worldwide].

Plants cultivated under the trade name *Cinchona ledgeriana* were considered to belong to *C. calisaya* by Andersson (Mem. New York Bot. Gard. 80: 55–57. 1998). The description of the plants treated as *C. ledgeriana* by W. C. Chen (in FRPS 71(1): 224–225. 1999) agrees with Andersson's classification of *C. lancifolia* Mutis and also generally

matches the cultivated hybrid *C. lucumifolia* Pavon ex Lindley × *C. pubescens* (Andersson, loc. cit.: 60).

**2. *Cinchona pubescens*** Vahl, Skr. Naturhist.-Selsk. 1: 19. 1790.  
鸡纳树 ji na shu

*Cinchona succirubra* Pavon ex Klotzsch.

Trees and shrubs, to 12 m tall; bark grayish brown, sometimes striped with white and/or longitudinally fissured; branches somewhat flattened to subterete or angled, densely pilosulous or hirtellous to puberulent or glabrescent. Petiole 1.5–4 cm, glabrous or puberulent to hirtellous; leaf blade drying papery, ovate, ovate-elliptic, or elliptic-oblong, 10–24.5 × 5.5–17 cm, adaxially glabrous to pilosulous or puberulent, abaxially hirtellous to pilosulous or puberulent and often reddened at least when young, base obtuse to rounded or truncate, apex obtuse to rounded; secondary veins 6–11 pairs, with pilosulous domatia; stipules 10–25 mm, sparsely pilosulous, obtuse to rounded. Inflorescences 6–23 × 6–23 cm, pilosulous or hirtellous to puberulent; bracts triangular, 0.5–3 mm; pedicels 1–3 mm. Calyx with ovary portion ellipsoid, 2–3 mm, densely pilosulous; limb 1.5–3 mm, sparsely to densely pilosulous or hirtellous, shallowly lobed; lobes triangular, 0.5–1 mm. Corolla white or pink, outside glabrescent to pilosulous or puberulent; tube cylindrical, 8.5–14 mm; lobes ovate-lanceolate, 4–6 mm, acute. Capsules 10–18(–41) × 5–7 mm, pilosulous to glabrescent; seeds 7–12 × 2–3 mm (including wing). Fl. and fr. Jun–Feb.

Cultivated. Guangxi (Nanning), Hainan, Taiwan, S Yunnan [native to Central America (Costa Rica) and South America (Bolivia, Colombia, Ecuador, Peru, Venezuela); often cultivated in tropical regions worldwide].

This is the most frequently cultivated species and hybrid parent of *Cinchona*. It is variable morphologically in cultivation and also in its native range.

## 17. CLARKELLA J. D. Hooker, Fl. Brit. India 3: 46. 1880.

岩上珠属 yan shang zhu shu

Chen Tao (陈涛); Charlotte M. Taylor

Small herbs from tubers, apparently perennial, unarmed, usually with a cluster of prophylls at stem base. Raphides present. Leaves opposite, isophyllous or sometimes markedly anisophyllous at basalmost node, without domatia; stipules persistent, inter-

petiolar and fused to petioles, triangular, perhaps sometimes glandular on margins. Inflorescences terminal, cymose, umbelliform, or subfasciculate, few to several flowered, pedunculate or sessile and tripartite, bracteate. Flowers pedicellate, bisexual with biology unknown. Calyx limb well developed, markedly reticulate veined, 5(–7)-lobed for ca. 1/2 length. Corolla white, slenderly salverform or funnellform-salverform, glabrous inside; lobes 5, valvate in bud. Stamens 5, inserted at base of corolla tube, included; filaments short. Ovary 2-celled, ovules numerous in each cell on axile placentas inserted not far below middle of septum; disk pilosulous; stigma 2-lobed, pubescent. Fruit indehiscent, obconical, dry, with funnellform calyx limb persistent; seeds numerous, small, subellipsoid, black papillose or -granular.

One species: China, N India, N Myanmar, Thailand.

This is a poorly known species or genus that apparently prefers wet limestone substrates and is similar to *Pseudopyxis*.

**1. *Clarkella nana*** (Edgeworth) J. D. Hooker, Fl. Brit. India 3: 46. 1880.

岩上珠 yan shang zhu

*Ophiorrhiza nana* Edgeworth, Trans. Linn. Soc. London 20: 60. 1846; *Clarkella siamensis* Craib; *O. pellucida* H. Léveillé.

Low herbs, to 10 cm tall; tubers ellipsoid-oblong, 1–1.5 cm, scaly; stems unbranched, subterete, glabrous to densely villosulous. Leaves opposite or sometimes only 1 leaf developing at basalmost node; petiole 0.5–5 cm, glabrous to puberulent; blade drying membranous or thinly papery, ovate to broadly ovate, 1–6 × 1–4 cm, both surfaces glabrous to puberulent or villosulous, base obtuse to cordulate and sometimes oblique,

apex acute to rounded; secondary veins 4–8 pairs; stipules triangular to narrowly triangular, 0.2–0.5 mm. Inflorescence 0.8–3 cm, 3–25-flowered, villosulous to puberulent; bracts ovate to narrowly oblong, 0.5–12 mm; pedicels 1–3.5 mm. Calyx densely puberulent to villosulous; hypanthium portion 1–2 mm; lobes triangular to ovate, 1–3 mm, markedly unequal on an individual flower. Corolla outside villosulous to puberulent; tube 10–14 mm; lobes elliptic to suborbicular, ca. 3 mm, ciliate. Fruit 7–8 mm, villosulous, with calyx limb becoming 2–4.5 mm with increase in size principally in growth of basal, unlobed portion. Fl. and fr. Aug.

On wet rocks, usually limestone; ca. 1400 m. Guangdong (Lian-nan), N Guangxi (Nandan), C Guizhou, N Yunnan [N India, N Myanmar, Thailand].

## 18. COFFEA Linnaeus, Sp. Pl. 1: 172. 1753.

咖啡属 ka fei shu

Chen Tao (陈涛); Charlotte M. Taylor

*Cafe* Adanson.

Shrubs or small trees, unarmed, often resinous on young growth; lateral branches usually spreading horizontally. Raphides absent. Leaves opposite or rarely in whorls of 3, distichous at least on lateral branches, often with foveolate and/or pilosulous domatia; stipules persistent, shortly united around stem, generally triangular, sometimes aristate. Inflorescences axillary, in each axil with 1 to several capitate to fasciculate, 1- to several-flowered cymes, these sessile to shortly pedunculate, bracteate; bracts often fused in cupulate pairs (i.e., forming a calyculus). Flowers sessile or shortly pedicellate, bisexual, monomorphic. Calyx limb obsolete or occasionally truncate or 4–6-toothed. Corolla white or pink, salverform or funnellform, inside glabrous or villous in throat; lobes 4–9, convolute in bud. Stamens 4–8, inserted in corolla throat, exerted; filaments absent or short; anthers dorsifixed near base. Ovary 2-celled, ovules 1 in each cell, attached at middle of septum; stigma 2-lobed, exerted. Fruit red, yellow, orange, blue, or black, drupaceous, globose to ellipsoid, fleshy or infrequently dry, with calyx limb when developed persistent; pyrenes 2, each 1-celled, with 1 seed, plano-convex, leathery or papery, on ventral (i.e., adaxial) face with longitudinal groove; seeds medium-sized to large, longitudinally grooved on ventral face; radicle terete, basiscopic.

About 103 species: native to tropical Africa, Madagascar, and the Mascarene Islands, several species and hybrids cultivated in moist tropical regions worldwide; five species (all introduced) in China.

Several species of *Coffea* are widely cultivated as a source of the drink coffee, a leading world commodity. Species limits and identifications are often difficult for wild plants, due to the complexity of the genus, its evolutionary behavior, and its numerous reduced morphological features; and the taxonomy of cultivated plants is additionally complicated by extensive, sometimes poorly documented hybridization for crop improvement during several centuries. The genus is native to Africa, Madagascar, and the Mascarenes; plants found outside this region are cultivated. Cultivated plants of *Coffea* generally persist after active cultivation is abandoned but do not generally establish growing permanent populations or spread. Cultivated *Coffea* is surveyed usefully by Purseglove (Trop. Crops: Dicot. 451–492. 1968). *Coffea arabica* is the most valuable species, producing highest quality coffee; this is a tetraploid species (Stoffelen et al., Opera Bot. Belg. 7: 237–248. 1996). *Coffea canephora* is generally the most productive species, producing a lower quality coffee; this is a diploid species (Purseglove, loc. cit.: 482–488). *Coffea liberica* also produces a lower quality coffee than *C. arabica*, is also diploid (Purseglove, loc. cit.: 488–491), and is less often cultivated. W. C. Ko (in FRPS 71(2): 22–25. 1999) additionally treated two species, *C. congensis* and *C. stenophylla*, that have been hybridized with commercial coffee (Purseglove, loc. cit.: 458) and may persist from old plantations, but these are also two names that have been widely confused in cultivation with *C. arabica* and *C. canephora* (Davis et al., Bot. J. Linn. Soc. 152: 483, 497. 2006). Some frequently used synonymous names are included here for reference.

*Coffea* is similar to *Psilanthus* J. D. Hooker, and some species have been variously treated in each genus depending on the current circum-

criptions. Davis et al. (Monogr. Syst. Bot. Missouri Bot. Gard. 104: 398–420. 2005) addressed this problem and concluded by separating the genera; in their circumscription *Psilanthus* is not known from China. Traditional *Coffea* descriptions often retain characters of *Psilanthus*, including that of W. C. Ko (loc. cit.: 20–25). *Coffea benghalensis* B. Heyne ex Schultes and *C. jenkinsii* J. D. Hooker were included in the Fl. Xizang. (4: 445–447. 1985). Davis et al. (loc. cit. 2006: 501) treated the first of these species as *P. benghalensis* (B. Heyne ex Schultes) J.-F. Leroy; Purselove (loc. cit.: 458) listed it as a native species of SE Asia and Sumatra sometimes cultivated for coffee in India. Davis et al. (loc. cit. 2006: 504) treated *C. jenkinsii* as a species of *Nostolachma* T. Durand: *N. jenkinsii* (J. D. Hooker) Deb & Lahiri.

The fruit of *Coffea* are sometimes described informally as “berries” because of their size and fleshy texture, but morphologically they are similar to other drupes of Rubiaceae; thus, this technical terminology is used here. The fruit of *Coffea* are also commercially sometimes called “cherries.”

- 1a. Blades of outer, unshaded leaves larger, usually 15–40 × 6–22 cm, with apex acuminate to obtuse; fruit red.  
 2a. Leaf blade without domatia or with glabrous foveolate domatia in abaxial vein axils; fruit ovoid-globose with length generally equal to width, 10–12 × 10–12 mm ..... 2. *C. canephora*  
 2b. Leaf blade with glabrous or pilosulous foveolate domatia in abaxial vein axils; fruit ellipsoid, longer than wide, 19–21 × 15–17 mm ..... 4. *C. liberica*
- 1b. Blades of outer, unshaded leaves smaller, mostly shorter than or up to 15 × 7 cm, with apex acute to at least shortly acuminate; mature fruit red to black or bluish black.  
 3a. Inflorescences with cymes 1 or 2 in each axil, each cyme 2–4-flowered; mature fruit black or bluish black; leaf blade narrowly elliptic-oblong to narrowly oblanceolate, 4–10 × 1.5–2.5 cm; corolla with 6–9 lobes ..... 5. *C. stenophylla*  
 3b. Inflorescences with cymes 1–4 per axil, each cyme 2–5-flowered; mature fruit red; leaf blade elliptic, elliptic-oblong, ovate-lanceolate, ovate, or lanceolate-elliptic, 3–8.5 cm wide; corolla with 4–6 lobes.  
 4a. Stipules aristate at apex; leaves of unshaded outer branches with lateral veins 7–13 pairs, with glabrous foveolate domatia in abaxial vein axils; fruit smooth or usually drying with a shallow sulcus or indentation along septum ..... 1. *C. arabica*  
 4b. Stipules obtuse to acute at apex; leaves of unshaded outer branches with lateral veins 6–9 pairs, with pilosulous domatia in abaxial vein axils; fruit drying smooth ..... 3. *C. congensis*

**1. *Coffea arabica* Linnaeus, Sp. Pl. 1: 172. 1753.**

小粒咖啡 xiao li ka fei

Small trees or large shrubs, 5–8 m tall; branches flattened to subterete, glabrous. Petiole 8–15 mm, glabrous; leaf blade drying thinly leathery, elliptic, elliptic-oblong, or occasionally ovate-lanceolate, (2–)6–14(–22) × 3.5–5(–8.5) cm, glabrous on both surfaces, base cuneate to obtuse or rarely rounded, margins occasionally crisped-undulate, apex acuminate with tip usually 10–15 mm; secondary veins 7–10(–13) pairs, without domatia or with glabrous foveolate domatia; stipules broadly triangular, 3–8(–12) mm, aristate at least on youngest branches. Inflorescences with 1 to several cymes in each axil, each cyme subcapitate to fasciculate, (1 or)2–5-flowered, sessile to pedunculate with peduncles to 4 mm; bracts cupuliform, 1–2 mm; pedicels to 2 mm. Calyx glabrous; ovary portion ellipsoid, 1–3 mm; limb truncate to undulate or denticulate, 0.2–1 mm. Corolla white, funnellform, outside glabrous; tube 5–15 mm; lobes (4 or)5(or 6), spatulate-elliptic, 9–20 mm, obtuse. Drupe red, ellipsoid to subglobose, 11–16 × 9–14 mm, when dry smooth or sometimes weakly didymous, glabrous. Fl. Mar–Jul, fr. Oct–Jan.

Cultivated in moist, usually cool tropical regions; 200–700 m. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Sichuan, Taiwan, Yunnan [native to E Africa (Ethiopia, N Kenya, Sudan); cultivated worldwide].

This species is tetraploid and is the source of “Arabica Coffee.” It has been widely hybridized with several other *Coffea* species to produce commercial coffee plants; flower size varies markedly among many of these.

**2. *Coffea canephora* Pierre ex Froehner, Notizbl. Königl. Bot. Gart. Berlin 1: 237. 1897.**

中粒咖啡 zhong li ka fei

*Coffea robusta* L. Linden.

Small trees or shrubs, 4–8 m tall; branches flattened becoming subterete, glabrous. Petiole 10–20 mm, glabrous; leaf blade drying thickly papery, elliptic, elliptic-oblong, or occasionally ovate-oblong, (12–)15–30(–40) × (4.5–)6–12(–22) cm, glabrous on both surfaces, base cuneate to obtuse, margins flat or occasionally crisped-undulate, apex acuminate with tip 10–18 mm; secondary veins (8–)10–12(–17) pairs, without domatia or with glabrous foveolate domatia; stipules triangular, 6–18 mm, obtuse to acute, aristate. Inflorescences with cymes 1–3(–7) in each axil, each cyme subcapitate to fasciculate, 3–6-flowered, subsessile to pedunculate with peduncles to 7 mm; bracts cupular, 1–3 mm; pedicels to 2 mm. Calyx glabrous; ovary portion ellipsoid, 1–2 mm; limb reduced or denticulate, 0.1–0.5 mm. Corolla white to pink, funnellform, outside glabrous; tube 5–16 mm; lobes (4 or)5–7(or 8), spatulate to narrowly elliptic, 8–19 mm, obtuse to rounded. Drupe red, subglobose, 10–12 × 10–12 mm, smooth when dry, glabrous. Fl. Apr–Jun, fr. Oct–Dec.

Cultivated in moist, often warm tropical regions. Fujian, Guangdong, Hainan, Yunnan [widespread in tropical Africa; commonly cultivated worldwide].

This species is diploid and is cultivated as “Robusta Coffee.” It has been widely hybridized with several other species to produce commercial coffee plants.

**3. *Coffea congensis* Froehner, Notizbl. Königl. Bot. Gart. Berlin 1: 235. 1897.**

刚果咖啡 gang guo ka fei

Shrubs, 2–6 m tall; branches flattened, glabrous. Petiole 5–10 mm, glabrous; leaf blade drying thinly leathery, elliptic-oblong to ovate or lanceolate-elliptic, 8–15 × 3–7 cm, glabrous on both surfaces, base cuneate or obtuse to rounded, apex acute to shortly acuminate with tip 5–10 mm; lateral veins 6–9 pairs, usually with pilosulous domatia; stipules triangular to broadly triangular, 2–5 mm, obtuse to acute but not aristate. Inflorescences with cymes 1–4 in each axil, each cyme subcapitate to fasciculate, 2–4-flowered, sessile to pedunculate with peduncles to 4 mm; bracts cupuliform, 1–3 mm; pedicels to 3 mm. Calyx glabrous; ovary portion cylindrical-ellipsoid, 1–1.5 mm; limb reduced or undulate, 0.1–0.5 mm. Corolla white, funnellform, outside glabrous; tube 7–10 mm; lobes 5 or 6, spatulate to narrowly elliptic, 7–10 mm, obtuse to rounded. Drupe red, ellipsoid to ovoid-oblong, 10–12 × 8–10 mm, smooth when dry, glabrous. Fr. Dec.

Cultivated in moist forest regions. Hainan [native to Africa (Congo River basin: Democratic Republic of Congo, Republic of Congo), growing as rheophyte; widely planted in tropical regions, though perhaps not so often in recent decades].

This species is presumably diploid and has been occasionally hybridized with other species to produce commercial coffee (Purse-glove, *Trop. Crops: Dicot.* 458. 1968; Bridson, *Fl. Trop. E. Africa, Rub. (Pt. 2)*, 703. 1988).

**4. *Coffea liberica*** W. Bull ex Hiern, *Trans. Linn. Soc. London, Bot.* 1: 171. 1876.

大粒咖啡 da li ka fei

*Coffea dewevrei* De Wildeman & T. Durand.

Small trees or large shrubs, 6–15 m tall; branches flattened to weakly angled, often rather stout, glabrous. Petiole 8–20 mm, often rather stout, glabrous; leaf blade drying thinly leathery to stiffly papery, elliptic to obovate or obovate-elliptic, 14–38 × 5.5–12(–20.5) cm, glabrous on both surfaces, base cuneate to obtuse, margins flat, apex obtuse to shortly acuminate with tip 4–10 mm; secondary veins 7–10(–13) pairs, without domatia or with glabrous to pilosulous foveolate domatia; stipules broadly triangular, 2–4.5 mm, obtuse to acute but not aristate. Inflorescences with cymes 1–3 per axil, each cyme fasciculate to subcapitate, 2–10-flowered, subsessile; bracts cupuliform, 1–3 mm; pedicels to 1 mm. Calyx glabrous; ovary portion ellipsoid-

cylindrical, 1.5–3.5 mm; limb reduced or glandular-denticulate, to 0.2 mm. Corolla white, funnellform, outside glabrous; tube 4–13 mm; lobes 6–8, spatulate to lanceolate or narrowly elliptic, 8–16 mm, obtuse to rounded. Drupe red, ellipsoid, 19–21 × 15–17 mm, smooth when dry, glabrous. Fl. Jan–May, fr. presumably Aug–Nov.

Cultivated in moist, warm to cool regions. Fujian, Guangdong, Hainan, Yunnan [widespread in tropical Africa; widely but not intensively cultivated in tropical regions worldwide].

This species is diploid and is cultivated as “Liberica Coffee.” It has been hybridized with several other species to produce commercial coffee plants.

**5. *Coffea stenophylla*** G. Don, *Gen. Hist.* 3: 581. 1834.

狭叶咖啡 xia ye ka fei

Shrubs to small trees, 3–6 m tall; branches flattened to subterete, glabrous. Petiole 3–5 mm, glabrous; leaf blade drying thinly leathery, narrowly oblanceolate to narrowly elliptic-oblong, 4–10 × 1.5–2.5 cm, glabrous on both surfaces, base acute to cuneate, margins generally flat, apex acuminate with tip 10–20 mm; secondary veins 7–10 pairs, without domatia or with glabrous foveolate domatia; stipules broadly triangular, 2–3.5 mm, obtuse to acute and sometimes shortly mucronate. Inflorescences with cymes 1 or 2 per axil, each branched to subcapitate or fasciculate, 2–4-flowered, subsessile to pedunculate with peduncles to 2.5 mm; bracts cupuliform, 1–2 mm; pedicels to 6 mm. Flower buds resinous. Calyx glabrous; ovary ellipsoid, 1–1.5 mm; limb reduced, truncate. Corolla white or pale pink, funnellform, outside glabrous to puberulent; tube 6–8 mm; lobes 6–8(or 9), spatulate, 12–15 mm, obtuse. Drupe black or bluish black, subglobose to ovoid, 12–13 × 8–10 mm. Fl. Mar–Apr, fr. Dec.

Cultivated in moist, probably warm forest regions. Hainan (Chengmai) [native to W Africa; formerly occasionally cultivated in Old World tropics, apparently primarily in coffee research stations].

This species is diploid and is cultivated as “Highland Coffee of Sierra Leone.” It has been occasionally hybridized with other species to produce commercial coffee plants and reported as cultivated by older authors (Purse-glove, *Trop. Crops: Dicot.* 459. 1968; Bridson, *Fl. Trop. E. Africa, Rub. (Pt. 2)*, 703. 1988, with documentation).

## 19. COPTOSAPelta Korthals, *Ned. Kruidk. Arch.* 2(2): 112. 1851.

流苏子属 liu su zi shu

Chen Tao (陈涛); Charlotte M. Taylor

Lianas or scandent shrubs, unarmed. Raphides absent. Leaves opposite, sometimes with domatia; stipules caducous, interpetiolar, triangular. Inflorescences axillary [to terminal], 1-flowered [or cymose and several to many flowered], pedunculate, bracteate. Flowers sessile, pedunculate, or pedicellate, bisexual, monomorphic. Calyx limb 5-lobed. Corolla pale yellow or white becoming yellowed with age, salverform, variously glabrous or pubescent inside; lobes 5, convolute to right in bud. Stamens 5, inserted in corolla throat, exserted; filaments short; anthers basifixed. Ovary 2-celled, ovules numerous in each cell on axile placentas; stigma fusiform, exserted. Fruit capsular, subglobose, loculicidally dehiscent with valves sometimes secondarily separating along septum, woody, with calyx limb persistent; seeds several, medium-sized to large, flattened, suborbicular, bordered by a regularly erose wing; endosperm fleshy; embryo straight; cotyledons short; radicle terete, basispic.

Sixteen species: China, Indonesia, Japan, Laos, Malaysia, Myanmar, New Guinea, Philippines, Thailand, Vietnam; one species in China.

The 3–5-porate pollen of *Coptosapelta* was studied by Verellen et al. (J. Pl. Res. 117: 57–68. 2003), who also noted that the genus has secondary pollen presentation and accumulates aluminum in the leaves. Based on molecular and some morphological characters, *Coptosapelta* is now considered rather isolated and one of the most basal lineages in Rubiaceae (Bremer et al., Syst. Biol. 48: 413–435. 1999; Bremer & Manen, Pl. Syst. Evol. 225: 43–72. 2000), with its closest relative probably being *Acranthera* and these two genera most closely related to *Luculia* (Rydin et al., Pl. Syst. Evol. 278: 101–123. 2009).

**1. *Coptosapelta diffusa*** (Champion ex Benth) Steenis, Amer. J. Bot. 56: 806. 1969.

流苏子 liu su zi

*Thyranospermum diffusum* Champion ex Benth, Hooker's J. Bot. Kew Gard. Misc. 4: 168. 1852.

Lianas or scandent shrubs, 2–5 m or taller, often much branched; branches densely hirtellous or strigillose to strigose often becoming glabrescent with age. Petiole 2–5 mm, hirsute to strigose or rarely glabrous; leaf blade drying papery to leathery and often yellowish green, ovate or ovate-oblong to lanceolate, 2–9.5 × 0.8–3.5 cm, adaxially rather shiny and glabrous except strigose to hirsute along costa, abaxially glabrous except strigose to hirsute on principal veins, base rounded to obtuse, margins sometimes sparsely ciliate and/or thinly revolute, apex acute or acuminate; secondary veins 4 or 5 pairs; stipules lanceolate to narrowly triangular, 2–7 mm, acute. Inflorescences

with peduncles slender, 3–20 mm, glabrous or usually strigose to hirtellous; bracts 1 or 2 on upper part of peduncle, 0.5–1 mm. Calyx glabrous to strigillose; ovary portion subglobose, 1–2 mm; limb deeply lobed; lobes ovate-triangular, 0.8–1 mm. Corolla outside glabrous to strigillose or sericeous, inside hirtellous in upper part of tube and usually onto basal half of lobes; tube cylindrical to somewhat funnellform, 8–15 mm; lobes elliptic-oblong to spatulate, 4–6 mm, obtuse to rounded. Anthers 3.5–4 mm. Stigma 2.5–3 mm. Capsule brownish yellow, compressed globose or compressed ellipsoid, weakly didymous, 4–6 × 5–8 mm; seeds 1.5–2 mm in diam. Fl. May–Jul, fr. Jun–Dec.

Thickets or forests on mountains or hills; 100–1500 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hubei, Hunan, Jiangxi, Sichuan, Taiwan, Yunnan, Zhejiang [Japan (Ryukyu Islands)].

This is a commonly collected species in China.

## 20. DAMNACANTHUS C. F. Gaertner, Suppl. Carp. 18. 1805.

虎刺属 hu ci shu

Chen Tao (陈涛); Charlotte M. Taylor

*Tetraplasia* Rehder.

Shrubs, sometimes with paired infrastipular or superaxillary spines; branches sometimes with complex sympodial growth with reduced internodes and prophylls (*Damnacanthus indicus*); roots at least sometimes moniliform (i.e., nodose or “node-like constricted”). Raphides present. Leaves opposite, apparently without domatia; stipules persistent and becoming hardened or sometimes falling by fragmentation, interpetiolar or shortly united around stem, generally triangular, acute or shortly bifid to multifid. Inflorescences pseudoaxillary, superaxillary, apparently terminal, and/or paired on short shoots giving an appearance of being axillary, 1-flowered or usually cymose to fasciculate and 2–4-flowered, subsessile to apparently shortly pedunculate (i.e., borne on a leafless short shoot), bracteate with bracts usually small and glandular-fimbriate. Flowers subsessile to pedicellate and often nodding, bisexual, monomorphic or distylous. Calyx limb cupular or campanulate, 4-lobed (or 5-lobed, *D. henryi*). Corolla white to yellow or pale purple, tubular-funnelform, often leathery, inside densely pubescent in throat to throughout; tube rarely fenestrate (*D. henryi*); lobes 4 (or 5, *D. henryi*), valvate in bud. Stamens 4, inserted in upper part of corolla tube, included or exserted; filaments short; anthers dorsifixed. Ovary 4-celled (or 2-celled, *D. henryi*), ovules 1 in each cell and attached near top of septum, campylotropous; stigmas 4 (or 2, *D. henryi*), linear, included or exserted. Fruit red, drupaceous, globose to ellipsoid or oblate, fleshy, with calyx limb persistent; pyrenes 4 (or 2, *D. henryi*), each with 1 seed, plano-convex, subglobose, ellipsoid, or obtusely trigonous; seeds medium-sized, subglobose to plano-convex; endosperm corneous; embryo small; radicle hypogeous.

About 13 species: China, N India, Japan, Korea, Laos, Myanmar, Vietnam; 11 species (six endemic) in China.

The morphology of *Damnacanthus* was reviewed in detail by Robbrecht et al. (Blumea 35: 307–345. 1991), who described its complex, sympodial growth pattern and variations found in different species. They considered the stems of *Damnacanthus* to be composed of sympodial units, with varying degrees of development of the individual parts in different species. The most characteristic and apparently complicated growth is found in *D. indicus*, in which each sympodial unit comprises a basal node bearing a pair of prophylls, similar to bud scales or reduced leaves; then, a developed internode; then, a node bearing a pair of normally developed foliage leaves, decussate in orientation to the prophylls; then, a node (without an intervening internode) bearing a pair of thorns, decussate in orientation to the leaves. Growth of the stem continues from one of the axillary buds of the foliage leaves, which gives the thorns the appearance of being stipular or superaxillary in position. The alternating prophylls and foliage leaves produce the characteristic heterophyllous growth of this genus. Species of *Damnacanthus* vary in the characteristic number of nodes in each sympodial unit and in the development (or not) of the thorns. Robbrecht et al. (loc. cit.) interpreted the characteristic “spines” of the genus as reduced shoot systems produced from the axillary buds subtending two undeveloped (and thus missing) leaves. They considered the characteristic 2- or 4-flowered inflorescences of *Damnacanthus* to be formed of one or two sympodial growth units, produced from one or both axils of a node bearing foliage leaves, with each of these units comprising three congested nodes, lacking separating internodes, with the basalmost nodes bearing bractlike scales and the terminal node producing a flower in each axil then stopping growth, thus comprising a 2-flowered cymule. They also noted that, although previous authors have described the ovules of *Damnacanthus* as amphitropous or pendulous, in fact the ovules are unique in the Rubiaceae in being campylotropous.

*Damnacanthus* is represented by at least three species in Japan (Fl. Japan 3a: 224–225. 1993), several of them apparently common and hybridizing, and its taxonomy has been rather intensively studied there and in Taiwan (e.g., Koidzumi, Acta Phytotax. Geobot. 3: 155–160. 1934), where it apparently has some medicinal use. *Damnacanthus* was revised for China by H. S. Lo (Acta Phytotax. Sin. 17(3): 104–109. 1979), then treated comprehensively by Y. Z. Ruan in FRPS (71(2): 167–176. 1999) in an essentially monographic work. Koidzumi (loc. cit.) recognized three sections within *Damnacanthus* and treated *Tetraplasia* as a separate genus, based largely on root characters, but these were not mentioned again until Y. Z. Ruan (loc. cit.: 169) recognized two sections in Chinese *Damnacanthus*, one of them under an unpublished name. The Chinese plants with spines were included in *D.* sect. *Damnacanthus*; the unarmed plants were separated by Koidzumi in *Tetraplasia* and were included by Ruan in his second, unnamed section.

Naiki and Nagamasu (J. Pl. Res. 116: 105–113. 2003; Amer. J. Bot. 91: 664–671. 2004) surveyed the breeding biology of several Japanese and Chinese species of *Damnacanthus* and found variation in breeding system among species, discovered a correlation between ploidy with breeding system but not leaf size, and reported distyly and dimorphic pollen in this genus.

- 1a. Branches glabrous, hispidulous, hirtellous, or puberulent when young, with spines in axils of stipules or leaves, with at least shortly developed spines at apices (these may appear to be stipule bristles if not observed carefully).
  - 2a. Spines 1–6 mm, persistent or deciduous when new leaves come out; leaf blade with midrib flat to impressed or thinly prominulous adaxially.
    - 3a. Leaf blade lanceolate or oblong-lanceolate, 4–15 cm, with or usually without microphylls (i.e., prophylls; reduced leaves), midrib flat to impressed adaxially; spines 1–2 mm; young branches and petioles puberulent or hispidulous; corollas 15–18 mm; stipules caducous ..... 2. *D. giganteus*
    - 3b. Leaf blade ovate, lanceolate, oblong-ovate, or oblong-lanceolate, 3–8 cm, with or without microphylls, midrib thinly prominulous adaxially; spines 2–6 mm; young branches and petioles sparsely hispidulous, puberulent, hirtellous, or glabrescent; corollas 10–15 mm; stipules persistent at least on distalmost nodes ..... 8. *D. macrophyllus*
  - 2b. Spines 3–25 mm, persistent; leaf blade with midrib thinly prominulous adaxially.
    - 4a. Leaf blade lanceolate or oblong-lanceolate, 3–7.5 cm, with 5–10 pairs of secondary veins ..... 11. *D. tsaii*
    - 4b. Leaf blade cordiform, ovate, elliptic, broadly elliptic, broadly ovate, or elliptic-ovate, 0.5–4 cm, with 2–4 pairs of secondary veins.
      - 5a. Leaf blade 0.5–3 cm, with secondary veins 2–4 pairs; spines 3–20 mm, 1/2 or more as long as leaf blade ..... 6. *D. indicus*
      - 5b. Leaf blade 3–4 cm, with secondary veins 3–5 pairs; spines 3–10 mm, less than 1/2 as long as leaf blade ..... 9. *D. major*
- 1b. Branches glabrous, without spines.
  - 6a. Low to dwarf shrubs, 0.5–1 m tall; corolla 8–10.5 mm; Taiwan ..... 1. *D. angustifolius*
  - 6b. Low to tall shrubs, 0.4–5 m tall; corolla 8–16 mm; mainland and Hainan.
    - 7a. Leaf blade lanceolate-linear, apex tapered to acute or acuminate tip.
      - 8a. Leaf blade when dry straw-yellow adaxially, olive-green abaxially, and thickly leathery, with secondary veins flat and indistinct adaxially, 6–9 pairs; calyx teeth sharply triangular ..... 3. *D. guangxiensis*
      - 8b. Leaf blade when dry gray, gray-green, or brownish green adaxially, gray-green, brownish green, or straw-yellow abaxially, and papery, with secondary veins flat and indistinct to prominulous adaxially, 9–16 pairs; calyx teeth broadly triangular ..... 7. *D. labordei*
    - 7b. Leaf blade lanceolate, narrowly elliptic, linear, elliptic, elliptic-ovate, elliptic-oblong, or oblong-lanceolate, apex acute to cuspidate or long but rather abruptly acuminate.
      - 9a. Ovary 2-celled, stigmas 2; corolla lobes variably 4 or 5 ..... 5. *D. henryi*
      - 9b. Ovary 4-celled, stigmas 4; corolla lobes regularly 4.
        - 10a. Leaves isomorphic (i.e., prophylls not present), with blade elliptic-ovate, elliptic-oblong, or oblong-lanceolate; Hainan ..... 4. *D. hainanensis*
        - 10b. Leaves dimorphic (i.e., regularly with prophylls), with blade linear at lower part of stem to elliptic, elliptic-oblong, or oblong-lanceolate at upper part of stem; mainland ..... 10. *D. officinarum*

**1. *Damnacanthus angustifolius*** Hayata, J. Coll. Sci. Imp. Univ. Tokyo 25(19): 113. 1908.

台湾虎刺 tai wan hu ci

*Damnacanthus angustifolius* var. *altimontanus* J. C. Liao; *D. angustifolius* f. *stenophyllus* (Koidzumi) T. Yamazaki; *D. angustifolius* var. *stenophyllus* (Koidzumi) Masamune; *D. stenophyllus* (Koidzumi) Masamune; *Tetraplasia angustifolia* (Hayata) Koidzumi; *T. stenophylla* Koidzumi.

Dwarf to low shrubs, 0.5–1 m tall. Branches glabrous,

without spines, when young subquadrate or usually with 8 alternately thick and thin longitudinal ridge lines, becoming 4-angled and yellow. Petiole of developed leaves 1.5–5 mm, glabrous; leaf blade drying stiffly papery, narrowly lanceolate, narrowly elliptic, linear-lanceolate, elliptic, or lanceolate-elliptic, 5–14 × 0.5–3 cm, glabrous throughout or sometimes sparsely puberulent to hispidulous adaxially, base acute to cuneate, margins flat and entire or irregularly serrulate, apex acute to acuminate; midrib thinly prominulous adaxially; secondary veins 5–9 pairs; stipules caducous, interpetiolar, triangular to spatulate, 0.5–1 mm, glabrous, acute to glandular-fimbriate. Inflores-

cences glabrous. Pedicels 2–5 mm. Calyx glabrous; hypanthium portion turbinate, 1.2–1.5 mm; limb ca. 1 mm, lobed for ca. 1/2; lobes triangular. Corolla white, glabrous outside; tube 6–8 mm; lobes triangular, 2–2.5 mm. Drupes oblate, ca. 4 × 6 mm. Fl. Jan–Apr, Oct, fr. Jan, Jun, Oct–Nov.

- Primary forests; 1000–2500 m. Taiwan.

*Damnacanthus angustifolius* var. *altimontanus* is recognized as distinct in the Kew Rubiaceae checklist (Govaerts et al., World Checkl. Rubiaceae; <http://www.kew.org/wcsp/rubiaceae/>; accessed on 15 Sep 2010) but was formally synonymized in the Fl. Taiwan (ed. 2, 4: 251. 1998), which is followed here.

This species was reported to be distylous by Naiki and Nagamasu (Amer. J. Bot. 91: 664–671. 2004). This species was reported from Guangdong by Merrill and Chun (Sunyatsenia 1(1): 80. 1930) but said to be restricted to Taiwan by Y. Z. Ruan in FRPS (71(2): 173–174. 1999); the Guangdong plants were apparently included by Ruan (loc. cit.: 174–175), followed here, as *Damnacanthus labordei*.

## 2. *Damnacanthus giganteus* (Makino) Nakai, Trees Shrubs Japan, 412. 1922.

短刺虎刺 duan ci hu ci

*Damnacanthus indicus* C. F. Gaertner var. *giganteus* Makino, Bot. Mag. (Tokyo) 18: 33. 1904; *D. macrophyllus* Siebold ex Miquel f. *giganteus* (Makino) T. Yamazaki; *D. macrophyllus* var. *giganteus* (Makino) Koidzumi; *D. subspinosus* Handel-Mazzetti.

Shrubs or rarely small trees, 0.5–2(–7.5) m tall. Roots moniliform. Branches usually 4-angulate or terete to flattened, dark green and sparsely hispidulous or puberulent to glabrous when young, becoming grayish yellow and glabrous, with few spines 1–2 mm and deciduous or sometimes persistent. Petiole of developed leaves 2–5 mm, sparsely puberulent to glabrous; leaf blade drying leathery, lanceolate or oblong-lanceolate, 4–14(–15) × 2–3(–5) cm, adaxially glabrous, abaxially glabrous or rarely densely puberulent along veins, base obtuse to rounded, margins flat to usually revolute and/or sometimes crisped, apex acuminate or acute; midrib flat to impressed adaxially; secondary veins 5–7 pairs; stipules caducous, interpetiolar, 1–2 mm, puberulent to glabrous, acute to bifid, thickened. Inflorescences strigillose to glabrescent. Pedicels 1–2 mm. Calyx strigillose to puberulent; hypanthium portion turbinate, 1.2–1.5 mm; limb 1–1.5 mm, lobed for 1/4–1/2; teeth broadly triangular. Corolla white, glabrous outside; tube 13–16 mm; lobes ovate-triangular, ca. 2 mm. Drupes ca. 4 × 5–8 mm, with pedicels sometimes elongated to 3 mm. Fl. Mar–May, fr. Oct–Jan.

Sparse or dense forests or thickets; 500–1100 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hunan, Jiangxi, Yunnan, Zhejiang [Japan].

Naiki and Nagamasu (Amer. J. Bot. 91: 664–671. 2004) reported the breeding biology of this species as monomorphic with “pin” type flowers (i.e., with stigmas exerted and anthers included).

## 3. *Damnacanthus guangxiensis* Y. Z. Ruan, Fl. Reipubl. Popularis Sin. 71(2): 320. 1999.

广西虎刺 guang xi hu ci

Shrubs, height not noted. Branches terete, glabrous, with-

out spines. Petiole ca. 6 mm, glabrous; leaf blade drying thickly leathery, straw-yellow adaxially, olive-green abaxially, lanceolate-linear, 13–22 × 1–2 cm, adaxially glabrous, abaxially sparsely pilosulous, base cuneate, margins entire and flat, apex acute then shortly tapered-acuminate; midrib prominent adaxially; secondary veins 6–9 pairs; stipules caducous or deciduous through fragmentation, interpetiolar, triangular, acute to glandular-fimbriate. Pedicels ca. 2 mm. Calyx glabrous; hypanthium portion cupuliform, ca. 1 mm; limb ca. 1 mm, lobed for ca. 1/2; teeth 4 or 5, narrowly triangular, acuminate. Corolla white, outside glabrous; tube ca. 8 mm, pubescent inside; lobes ovate to triangular, ca. 4 mm. Fruit unknown. Fl. winter–spring.

- Forests on mountains; ca. 1200 m. Guangxi (Lingyun).

## 4. *Damnacanthus hainanensis* (H. S. Lo) H. S. Lo ex Y. Z. Ruan, Fl. Reipubl. Popularis Sin. 71(2): 176. 1999.

海南虎刺 hai nan hu ci

*Damnacanthus henryi* (H. Léveillé) H. S. Lo subsp. *hainanensis* H. S. Lo, Acta Phytotax. Sin. 17(3): 108. 1979.

Shrubs, 1–4 m tall. Branches brown, angulate or ridged, glabrous, without spines. Petiole of developed leaves 2–8 mm, glabrous; leaf blade drying black, elliptic-ovate, oblong, or oblong-lanceolate, 6–11 × 2–4.5 cm, glabrous, base rounded or cuneate, margins thinly revolute, apex cuspidate; midrib prominulous adaxially; secondary veins 5–7 pairs; stipules caducous, interpetiolar, triangular. Pedicels ca. 2 mm. Calyx limb subtruncate or lobed; teeth triangular. Corolla white, outside glabrous; tube ca. 14 mm; lobes 4, ovate-lanceolate. Drupes ca. 8 mm in diam., glabrous. Fl. May, fr. Nov.

- Forests, forest margins; 800–1800 m. Hainan.

## 5. *Damnacanthus henryi* (H. Léveillé) H. S. Lo, Acta Phytotax. Sin. 17(3): 108. 1979.

云桂虎刺 yun gui hu ci

*Canthium henryi* H. Léveillé, Repert. Spec. Nov. Regni Veg. 13: 178. 1914; *Prismatomeris brevipes* Hutchinson; *P. henryi* (H. Léveillé) Rehder.

Shrubs or small trees, 1.5–5 m tall. Branches 4-angled to flattened, pale brown, smooth, glabrous. Petiole of developed leaves 2–5 mm, glabrous; leaf blade drying papery or leathery, lanceolate, narrowly elliptic, elliptic, or elliptic-oblong, 5–13 × 1–4 cm, glabrous, base acute or cuneate and often decurrent, margins entire and flat to usually thinly revolute, apex acute to long acuminate; midrib thinly prominulous adaxially; secondary veins 5–7 pairs; stipules caducous, interpetiolar, triangular to narrowly triangular, 1–1.5 mm, glabrous, acute. Inflorescences glabrous. Pedicels 2–3.5 mm. Calyx glabrous; hypanthium portion turbinate, 1–1.5 mm; limb ca. 0.8 mm, lobed for 2/3–3/4; lobes 4 or 5, narrowly triangular, sometimes separated by subtruncate sinuses. Corolla white or pale purple, glabrous outside; tube 9–12 mm, fenestrate at base; lobes 4 or 5, ovate-lanceolate, 3–4 mm. Drupes 5–8 mm in diam.; pyrenes 2, subglobose. Fl. Oct, fr. Dec–Feb.

- Dense forests on mountains; 1200–2500 m. Guangxi, Guizhou, Yunnan.

This species is here provisionally included in *Damnacanthus* based on its inflorescence morphology. It was reported to be distylous by Naiki and Nagamasu (Amer. J. Bot. 91: 664–671. 2004).

**6. *Damnacanthus indicus*** C. F. Gaertner, Suppl. Carp. 18. 1805.

虎刺 hu ci

*Damnacanthus esquirolii* H. Léveillé; *D. formosanus* (Nakai) Koidzumi; *D. indicus* var. *formosanus* Nakai; *D. indicus* var. *lancifolius* Makino; *D. lancifolius* (Makino) Koidzumi.

Shrubs, 0.3–1.5 m tall. Roots fleshy, moniliform. Branches densely hispidulous to hirtellous, sometimes becoming glabrescent, terete or sometimes 4-angled, with numerous persistent spines 3–20 mm. Petiole of developed leaves 0.5–3 mm, strigillose, hispidulous, or glabrescent; leaf blade drying stiffly papery to leathery and discolorous, ovate, cordiform, elliptic-ovate, elliptic, or broadly elliptic, 0.5–2(–3) × 0.5–1(–1.5) cm, adaxially glabrous, abaxially glabrous or sparsely hirtellous to strigillose along veins, base obtuse to rounded, truncate, or cordulate, sometimes oblique, margins entire and flat, apex acute; midrib thinly prominulous adaxially; secondary veins 2 or 3(or 4) pairs; stipules quickly fragmenting or caducous, interpetiolar, narrowly to broadly triangular, 0.3–1 mm, strigillose to glabrescent, acute to glandular-fimbriate. Inflorescences strigillose to hispidulous. Pedicels 0.5–8 mm. Calyx strigillose to glabrous; hypanthium portion turbinate, 1–1.5 mm; limb 0.8–2 mm, lobed for 1/4–4/5; lobes broadly triangular to narrowly triangular. Corolla white, glabrous outside; tube 7–9 mm; lobes elliptic to lanceolate-elliptic, 2.5–5 mm. Drupes 4–6 mm in diam. Fl. Mar–Jun, fr. Mar–Jan.

Sparse or dense forests on hills or mountains, rocky thickets; 100–1500 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hubei, Hunan, Jiangsu, Jiangxi, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [N and NE India, Japan, Korea].

Naiki and Nagamasu (Amer. J. Bot. 91: 664–671. 2004) reported that populations they studied are either monomorphic, with only pin-type flowers, or distylous. Koidzumi (Acta Phytotax. Geobot. 3: 158. 1934) reported *Damnacanthus lancifolius* from Yunnan and treated *D. esquirolii* as a synonym of that name; these names were apparently overlooked by Y. Z. Ruan (in FRPS 71(2): 169. 1999).

**7. *Damnacanthus labordei*** (H. Léveillé) H. S. Lo, Acta Phytotax. Sin. 17(3): 107. 1979.

柳叶虎刺 liu ye hu ci

*Canthium labordei* H. Léveillé, Repert. Spec. Nov. Regni Veg. 13: 178. 1914; *Lasianthus labordei* (H. Léveillé) Rehder; *Prismatomeris labordei* (H. Léveillé) Merrill ex Rehder; *P. linearis* Hutchinsonson.

Small shrubs, 0.4–2 m tall. Roots fleshy, moniliform. Branches 4-angled to flattened and usually with a well-developed longitudinal ridge descending from stipule midrib on each side, yellow to pale brown, glabrous, without spines. Petiole of developed leaves 2–6 mm, glabrous; leaf blade drying papery, gray to brownish green adaxially, gray-green, brownish green, or straw-yellow abaxially, lanceolate to lanceolate-linear, 5–21 × 0.6–2.5 cm, glabrous or sometimes pubescent along veins adaxially, base cuneate or acute, margins entire or irregularly

serrulate and flat to thinly revolute, apex tapered and acuminate with tip often flexuous; midrib thinly prominulous adaxially; secondary veins 9–16 pairs; stipules caducous, interpetiolar, triangular, 0.5–1 mm, acute to glandular-fimbriate. Inflorescences glabrous. Pedicels 2–3 mm. Calyx glabrous; hypanthium portion turbinate, ca. 1 mm; limb 0.5–1 mm, lobed for 1/4–1/2; lobes broadly triangular. Corolla white to yellow, outside glabrous; tube 5–9 mm; lobes ovate, ca. 3 mm. Drupes ca. 8 mm in diam. Fl. Feb–Mar, Oct–Dec, fr. Sep–Dec.

Sparse or dense forests or thickets; 800–1800 m. N Guangdong, N Guangxi, Guizhou, Hunan, Sichuan, Yunnan [Vietnam].

This species was reported to be distylous by Naiki and Nagamasu (Amer. J. Bot. 91: 664–671. 2004).

**8. *Damnacanthus macrophyllus*** Siebold ex Miquel, Ann. Mus. Bot. Lugduno-Batavi 3: 110. 1867 [“*macrophylla*”].

浙皖虎刺 zhe wan hu ci

*Damnacanthus indicus* C. F. Gaertner f. *macrophyllus* (Siebold ex Miquel) Makino; *D. indicus* var. *macrophyllus* (Siebold ex Miquel) Makino; *D. indicus* var. *parvispinus* Koidzumi; *D. major* Siebold & Zuccarini var. *macrophyllus* (Siebold ex Miquel) Maximowicz; *D. major* var. *parvispinus* (Koidzumi) Koidzumi; *D. major* var. *submitis* Maximowicz ex Regel; *D. moniliformis* Koidzumi; *D. minutispinus* Koidzumi; *D. shanii* K. Yao & M. B. Deng.

Shrubs, 1–2 m tall. Roots fleshy, moniliform. Branches puberulent to hispidulous, with 8 alternately thick and thin striae, with few deciduous or persistent spines 2–6 mm. Petiole of developed leaves 1–2 mm, glabrous or sparsely puberulent to puberulent or hirtellous; leaf blade drying stiffly papery, ovate to oblong-ovate, lanceolate, or oblong-lanceolate, 3–6(–8) × 1–2.5(–3) cm, adaxially glabrous, abaxially glabrous or puberulent along veins, base cuneate to rounded, margins flat to thinly revolute, apex shortly acuminate or acute; midrib thinly prominent adaxially; secondary veins 3 or 4(–7) pairs; stipules persistent, interpetiolar, triangular, 0.3–1 mm, puberulent to glabrescent, acute to glandular-multifid or -fimbriate. Inflorescences strigillose to puberulent. Pedicels 1–2 mm. Calyx strigillose to glabrescent; hypanthium portion obconic, 1.2–1.5 mm; limb 1–1.5 mm, lobed for 1/3–1/2; lobes triangular to ovate. Corolla white, outside glabrous; tube 8(–13) mm; lobes ovate-triangular, ca. 2 mm. Drupes ca. 5 mm in diam., with pedicels sometimes elongated to 5 mm. Fl. Apr–Jun, fr. Oct–Dec.

Streamsides in sparse or dense forests on mountains; 800–1000 m. Anhui, Fujian, Guangdong, Guizhou, Yunnan, Zhejiang [Japan].

Naiki and Nagamasu (Amer. J. Bot. 91: 664–671. 2004) reported the breeding biology of this species as monomorphic with “pin” type flowers.

“*Damnacanthus subspinosus* var. *salicifolius*” (M. B. Deng & K. Yao, Bull. Bot. Res., Harbin 10(4): 2. 1990) belongs here but was not validly published because two gatherings were designated as types (Vienna Code, Art. 37.2).

**9. *Damnacanthus major*** Siebold & Zuccarini, Abh. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. 4(3): 177. 1846.

大卵叶虎刺 da luan ye hu ci

*Damnacanthus indicus* C. F. Gaertner f. *major* (Siebold & Zuccarini) Makino; *D. indicus* subsp. *major* (Siebold & Zuccarini) T. Yamazaki; *D. indicus* var. *major* (Siebold & Zuccarini) Makino ex Nakai.

Shrubs, 1–2 m tall. Roots fleshy, white or pale purple, moniliform. Branches densely hispidulous to hirtellous when young, sometimes becoming glabrescent, terete or sometimes 4-angled, with numerous spines 3–10 mm, persistent. Petiole of developed leaves 1–4 mm, strigillose to hirtellous; leaf blade drying papery, broadly ovate, ovate, or elliptic-ovate, 3–4 × 1.5–2 cm, adaxially glabrous, abaxially glabrous or sometimes sparsely hispidulous along veins, base obtuse or rounded, margins flat and entire, apex acute; midrib thinly prominent adaxially; secondary veins 3–5 pairs; stipules quickly fragmenting or caducous, interpetiolar, broadly triangular, 0.5–1 mm, strigillose to glabrescent, obtuse to acute. Inflorescences strigillose. Pedicels ca. 1 mm. Calyx strigillose or puberulent; hypanthium portion obconic, 1–2 mm; limb ca. 2 mm, deeply lobed; lobes narrowly to broadly triangular. Corolla white, outside glabrous; tube ca. 11 mm; lobes ovate-triangular, ca. 4 mm. Drupes 5–10 mm in diam. Fl. Apr, fr. winter.

Sparse forests and thickets on mountains; 600–700 m. Guangdong, Zhejiang [Japan, Korea].

These plants were treated as a subspecies of *Damnacanthus indicus* in the Fl. Japan (3a: 224–225. 1993) and also considered there to be restricted to Japan and Korea.

**10. *Damnacanthus officinarum*** C. C. Huang in H. S. Lo, Acta Phytotax. Sin. 17(3): 108. 1979.

四川虎刺 si chuan hu ci

Shrubs, 1–2.5 m tall. Roots fleshy, moniliform. Branches slightly flattened when young becoming terete, glabrous, without spines. Petiole of developed leaves ca. 5 mm, glabrous; leaf blade drying leathery, brown or straw-yellow adaxially, straw-yellow or olive-green abaxially, elliptic, elliptic-oblong, or oblong-lanceolate on upper part of stem, to linear on lower part of

stem, 5–13(–16) × 2–4(–6) cm, glabrous, base cuneate to acute, margins entire and flat to thinly revolute, apex acute to acuminate; midrib thinly prominent adaxially; secondary veins 6–8 pairs; stipules caducous, interpetiolar, triangular, ca. 1 mm, glabrous, acute. Inflorescences glabrous. Pedicels ca. 2 mm. Calyx glabrous; hypanthium portion cupuliform, ca. 1.5 mm; limb 0.5–1 mm, undulate to lobed for ca. 1/2; lobes broadly triangular. Corolla in bud pale green, glabrous outside, 10–12 mm. Drupes 6–7 mm in diam. Fl. winter–spring, fr. Oct–Dec.

• Thickets or forests on hills; 700–900 m. Hubei, Hunan, Sichuan.

This species was reported to be distylous by Naiki and Nagamasu (Amer. J. Bot. 91: 664–671. 2004).

**11. *Damnacanthus tsaii*** Hu, Bull. Fan Mem. Inst. Biol. 6: 178. 1935.

西南虎刺 xi nan hu ci

Shrubs, 1–3 m tall. Branches densely hirtellous, with spines 4–25 mm, persistent. Petiole of developed leaves 1–2 mm, glabrous or pilosulous; leaf blade drying papery, lanceolate or oblong-lanceolate, 3–7.5 × 0.9–2.4 cm, adaxially glabrous, abaxially glabrous or hirtellous along veins when young, base cuneate or rounded, margins entire to irregularly serrulate and thinly revolute, apex acuminate; midrib thinly prominent adaxially; secondary veins 5–8(–10) pairs; stipules quickly deciduous, interpetiolar, broadly triangular, usually acuminate. Pedicels ca. 2 mm. Calyx glabrous; hypanthium portion obconic, ca. 1 mm, lobed for ca. 1/2; lobes 4(or 5), triangular to subulate-triangular. Corolla white, ca. 12 mm, outside glabrous; lobes ovate-triangular. Drupes ca. 5 mm in diam. Fl. Apr, fr. winter–spring.

• Forests, forest margins, roadsides, rocky mountains; 1000–2500 m. Sichuan, Yunnan.

Naiki and Nagamasu (Amer. J. Bot. 91: 664–671. 2004) reported that all flowers of this species seen resemble the long-styled form of distylous species.

## 21. DENTELLA J. R. Forster & G. Forster, Char. Gen. Pl. 13. 1775.

小牙草属 xiao ya cao shu

Chen Tao (陈涛); Charlotte M. Taylor

Herbs, annual or perennial, prostrate, unarmed. Raphides present. Leaves opposite, usually relatively small, without domatia; stipules persistent, interpetiolar and frequently fused to petioles, triangular, entire to erose, often scarious. Inflorescences terminal or displaced to pseudoaxillary, 1-flowered, ebracteate, subsessile or pedunculate. Flowers bisexual, remarkably reduced. Calyx with ovary portion sometimes papillose-villous with distinctive flattened trichomes; limb tubular, 5-lobed or -toothed. Corolla white to pink, funnellform, inside frequently pubescent in throat; lobes 5, valvate in bud. Stamens 5, inserted at middle or perhaps base of corolla tube, included; filaments short; anthers basifixed or perhaps dorsifixed, included. Ovary 2-celled, ovules numerous in each cell inserted on axile subglobose placentas; stigmas 2, filiform, included. Fruit indehiscent, subglobose to ellipsoid, dry, papery, sometimes papillose-villous with distinctive flattened trichomes, with calyx limb persistent; seeds numerous, small, angled; testa granulate; endosperm fleshy; embryo minute.

About ten species: S Asia to Oceania, with one species apparently adventive in North America; one species in China.

The seeds and capsules of this species were described in detail by Terrell and Robinson (J. Bot. Res. Inst. Texas 1(1): 373–384. 2007).

**1. *Dentella repens*** (Linnaeus) J. R. Forster & G. Forster, Char. Gen. Pl. 13. 1775.

小牙草 xiao ya cao

*Oldenlandia repens* Linnaeus, Syst. Nat., ed. 12, 2: 126; Mant. Pl. 1: 40. 1767; *Dentella matsudae* Hayata; *D. repens* var. *grandis* Pierre ex Pitard.

Dwarf herbs, creeping, much branched, rather fleshy; branches flattened to angled, glabrous or puberulent, often rooting at nodes. Leaves subsessile to shortly petiolate; petiole to 1[–4] mm; blade drying stiffly papery, oblong-lanceolate, oblanceolate, or spatulate, 4–7[–10] × 1–2[–4] mm, glabrous or sparsely hirtellous at least along margins and principal veins, base cuneate to acute, margins flat, apex obtuse to acute; secondary veins not visible; stipules triangular, ca. 1 mm, entire to erose. Flowers solitary at forks of branchlets or rarely along stems, subsessile or with pedicel to 1[–2] mm. Calyx with ovary portion subglobose, ca. 1 × 1–1.5 mm, densely papillose-villous with flattened trichomes; limb 1–1.2 mm, deeply lobed; lobes narrowly triangular. Corolla white or pale yellow, 3–8[–12] mm, glabrous outside, sparsely villous inside throat; lobes triangular-ovate, 1–2 mm, acute. Fruit compressed globose, 3–5 × 3–5 mm, densely villous with multicellular, transparent, flat-

tened, bulbous-tipped trichomes; seeds 0.3–0.5 mm. Fl. winter, fr. summer.

Wet sites in fields; sea level or higher. Guangdong, Hainan, Taiwan, Yunnan (Xishuangbanna) [India, Indonesia, Malaysia, Myanmar, Nepal, Philippines, Sri Lanka, Thailand, Vietnam; Australia, Oceania; adventive in North America (E United States, Mexico)].

The Fl. Taiwan (ed. 2, 4: 252. 1998) described markedly larger leaves, petioles, pedicels, and corollas than seen on specimens studied for this work or found in other descriptions; these measurements are included above provisionally in brackets. Two varieties were recognized by Xing and Wu (Fl. Nansha Islands, 200–201. 1996): *Dentella repens* var. *repens*, with flowers ca. 3 mm, and *D. repens* var. *grandis*, with flowers 6–8 mm; their description of the second variety corresponds to the larger flower measurements given in Fl. Taiwan. These varieties were subsequently synonymized by H. S. Lo (in FRPS 71(1): 21. 1999) and are provisionally synonymized here.

## 22. DIODIA Linnaeus, Sp. Pl. 1: 104. 1753.

双角草属 shuang jiao cao shu

Chen Tao (陈涛); Charlotte M. Taylor

Herbs [or sometimes small shrubs], annual or perennial, unarmed. Raphides present. Leaves opposite or sometimes apparently verticillate due to clustered leaves on unexpanded axillary stems, sessile to shortly petiolate, without domatia; stipules persistent, interpetiolar and fused to petioles, sheath truncate to rounded and often membranous, setose. Inflorescences axillary and sometimes also terminal, glomerulate or capitate, few to several flowered, sessile, bracteate or bracts reduced. Flowers sessile, bisexual, monomorphic. Calyx limb deeply 2- or 4-lobed; lobes sometimes unequal in pairs. Corolla white, pink, or pale purple, funnellform or salverform, inside variously glabrous or pubescent; lobes 4, valvate in bud. Stamens 4, inserted in corolla throat, exerted; filaments developed; anthers dorsifixed. Ovary 2-celled, ovules 1 in each cell, axile and attached at middle of septum; stigmas 2, capitate to linear, exerted. Fruit schizocarpous or indehiscent, ellipsoid to obovoid, papery to cartilaginous, bony, or corky, with calyx limb persistent; mericarps (i.e., cocci) 2, indehiscent, with 1 seed, ellipsoid to plano-convex; seeds ellipsoid-oblong, medium-sized, often sulcate to convex on adaxial (i.e., ventral) surface; endosperm corneous; embryo straight; cotyledons broad; radicle hypogynous.

About 50 species: warm temperate and tropical America and Africa, with several American species naturalized in the Old World tropics; two species (both introduced) in China.

Measurements and characters in brackets below are found in plants of other regions and are included here to aid future identifications of these species, which may be introduced more than once in China and have more variation here than currently documented.

- 1a. Plants erect; fruit papery to bony, 3–3.5 mm, usually separating and dispersing as 2 indehiscent mericarps ..... 1. *D. teres*  
1b. Plants prostrate to weakly ascending; fruit corky, 6–9 mm, usually not separating into mericarps ..... 2. *D. virginiana*

### 1. *Diodia teres* Walter, Fl. Carol. 87. 1788.

山东丰花草 shan dong feng hua cao

*Borreria shandongensis* F. Z. Li & X. D. Chen; *Diodella teres* (Walter) Small; *Spermacoce shandongensis* (F. Z. Li & X. D. Chen) Govaerts.

Herbs, annual, erect, to 30[–50] cm tall; stems somewhat flattened to slightly [or sharply] 4-angled, pilosulous [and/or pilose to glabrescent]. Leaves sessile; blade drying papery, linear-lanceolate, [8–]20–40 × [1–]3–5[–7] mm, both surfaces hispidulous, base obtuse [to rounded or subcordate], margin weakly [to strongly] revolute, apex acute to acuminate; secondary veins indistinct; stipule sheaths truncate, 1–2.5 mm, pilosulous to glabrescent, with 5–9 setae 1–7 mm. Flowers 1[–3] per axil or 1[–6] per node; bracts reduced. Calyx pilosulous to glabrescent; ovary portion obovoid, 0.5–0.8 mm; limb deeply lobed; lobes lanceolate, ca. 1 mm, pilosulous to glabrescent. Corolla pink [to pale purple or blue], funnellform, hispidulous to

glabrescent outside; tube [1.5–]4[–7] mm, glabrescent inside; lobes elliptic-oblong, 0.5–2 mm. Fruit obovoid, [1.5–]3–3.5 mm, papery to bony, hispid to hispidulous, separating into 2 mericarps each with a Y-shaped sulcus on adaxial surface; seeds ca. 2.5 mm, yellowish brown when dry, longitudinally 1-grooved. Fl. and fr. Aug–Sep.

Disturbed, often degraded open ground. S Fujian (Jinmen), Shandong (Qingdao) [native to Antilles and North and South America; adventive in N Africa, Japan, Korea, and Madagascar].

*Diodia teres* has not been widely reported previously from Asia, but it is known from Japan (Honshu, 18 Oct 1995, S. Tsuagaru & G. Murata 22898, MO!) at a similar latitude to its occurrence in China and probably should be expected elsewhere.

### 2. *Diodia virginiana* Linnaeus, Sp. Pl. 1: 104. 1753.

双角草 shuang jiao cao

Herbs, perennial, prostrate to weakly ascending, to 60 cm tall; stems 4-angled, retrorse pilose or -pilosulous along angles.

Leaves petiolate; petiole ca. 3 mm; blade drying papery, elliptic-lanceolate to oblanceolate, 20–32 × 4–8 mm, both surfaces glabrescent, base cuneate and sometimes oblique, apex acute; secondary veins 4 or 5 pairs; stipule sheaths truncate to rounded, 2–3 mm, glabrous, with 3–5 setae 1–4 mm. Flowers 1 or sometimes 2 or 3 per axil, 2 or sometimes 4–6 per node; bracts reduced. Calyx villous to pilose; ovary portion obconic, ca. 1 mm; lobes narrowly triangular-lanceolate, [2–]5–7[–10] mm, often unequal on an individual flower. Corolla white, glabrous inside and outside; tube 5.5–6 mm; lobes triangular, 4–5[–6] mm, sometimes pubescent adaxially. Fruit corky, ellipsoid, 6–9 × 4–6 mm, distinctly 8-ridged, pilose or villous to glabrescent, usually not separating into mericarps; seeds 5–6 × 2–3 mm, reticulate. Fl. and fr. Aug–Sep.

Bamboo forest sides. Naturalized in Taiwan [native to C and E

North America; perhaps naturalized in Mexico and Central America; adventive in Japan].

This species is rather widely but infrequently and locally naturalized in tropical and subtropical areas, especially near seaports (Taylor, Monogr. Syst. Bot. Missouri Bot. Gard. 85(3): 2206–2284. 2001), and probably should be expected elsewhere in Asia. The plants are usually found in microsites with moving water, and apparently the fruit are frequently water-dispersed.

Hsieh and Chaw (Bot. Bull. Acad. Sin. 28: 44–45. 1987) gave the number of calyx lobes as 2; this is the first report of this condition for *Diodia virginiana*, and their illustration of the flowers suggest that there may at least sometimes be 4 lobes. They also gave some unusual measurements for the corolla of their plant, with the tube said to be 15 mm and the limb to 18 mm wide; both of these are exceptionally large measurements that are unknown in other plants of this species.

### 23. DIPLOSPORA Candolle, Prodr. 4: 477. 1830.

狗骨柴属 *gou gu chai shu*

Chen Tao (陈涛); Charlotte M. Taylor

Shrubs or small trees, sometimes polygamo-dioecious, unarmed; branches sometimes superaxillary. Raphides absent. Leaves opposite, sometimes with domatia; stipules persistent or deciduous, shortly united around stem, triangular. Inflorescences axillary or sometimes supra-axillary, cymose to fasciculate or glomerulate, few to many flowered, sessile to pedunculate, bracteate. Flowers subsessile to pedicellate, bisexual and monomorphic or unisexual. Calyx limb truncate to 4(or 5)-lobed or -denticulate. Corolla white, pale green, or pale yellow, salverform, inside pubescent in throat and sometimes on lower part of lobes; lobes 4(or 5), convolute in bud. Stamens 4(or 5), inserted in corolla throat, exerted; filaments short; anthers dorsifixed. Ovary 2-celled, ovules 1–3(–6) in each cell on axile placentas; stigma 2-lobed, shortly exerted. Fruiting pedicels often elongating notably. Fruit yellow, orange, or red, baccate, subglobose or ellipsoidal-globose, fleshy or leathery, with calyx limb usually persistent; seeds several, medium-sized, angled, subglobose, or somewhat flattened, embedded in pulp derived from placenta; hilum linear or comma-shaped; radicle hypogynous.

About 20 species: tropical and subtropical Asia; three species (one endemic) in China.

This genus was reviewed by Robbrecht and Puff (Bot. Jahrb. Syst. 108: 114–119. 1986), then in more detail by Ali and Robbrecht (Blumea 35: 279–305. 1991). The description of the sexuality of the plants and flowers here follows Ali and Robbrecht (loc. cit.) and Puff et al. (Rubiaceae of Thailand, 84. 2005).

- 1a. Leaves drying leathery or thickly papery, glabrous and rather shiny on both surfaces, abaxially with secondary veins plane or thinly prominulous, higher order venation hardly or not visible, without domatia; petioles glabrous ..... 1. *D. dubia*
- 1b. Leaves drying papery or thinly leathery, glabrescent, strigillose, puberulent, tomentulose, or hirtellous abaxially or on both surfaces, abaxially with secondary veins prominent, higher order venation well marked and usually thinly raised, usually with domatia; petioles glabrescent, strigillose, or tomentulose.
- 2a. Leaves abaxially pubescent along principal veins but glabrescent or very sparsely pubescent on blade; stipules usually deciduous after distalmost 1 or 2 nodes ..... 2. *D. fruticosa*
- 2b. Leaves densely tomentulose abaxially; stipules usually persistent ..... 3. *D. mollissima*

**1. *Diplospora dubia*** (Lindley) Masamune, Trans. Nat. Hist. Soc. Formosa 29: 269. 1939.

狗骨柴 *gou gu chai*

*Canthium dubium* Lindley, Bot. Reg. 12: t. 1026. 1826; *Diplospora buisanensis* Hayata; *D. tanakae* Hayata; *D. viridiflora* Candolle; *Tricalysia dubia* (Lindley) Ohwi; *T. lutea* Handel-Mazzetti; *T. viridiflora* (Candolle) Masamune; *T. viridiflora* var. *buisanensis* (Hayata) Yamamoto; *T. viridiflora* var. *tanakae* (Hayata) Yamamoto.

Shrubs or trees, 1–12 m; branches terete to somewhat flattened, glabrous. Petiole 4–15 mm, glabrous; leaf blade drying

leathery or rarely thickly papery, and yellowish green to brown, ovate-oblong, elliptic-oblong, elliptic, or lanceolate, 4–19.5 × 1.5–8 cm, both surfaces glabrous and rather shiny, base acute, cuneate, or obtuse, sometimes slightly oblique, margins often thinly revolute, apex acute to acuminate with tip often ultimately obtuse; secondary veins 5–11 pairs, without domatia; stipules persistent on distalmost 1 or 2(–4) nodes, ovate to triangular, 5–8 mm, glabrous, densely white sericeous inside, acute, keeled in upper part with keel often extending into an arista 1–4 mm. Inflorescences subcapitate to congested-fasciculate, 6–10 mm, puberulent to strigillose, tomentulose, or puberulent, sessile or subsessile; bracts triangular, ca. 1 mm, frequently fused in pairs, acute; pedicels 1–4 mm. Calyx strigillose

to glabrescent; ovary portion obconic to obovoid, 0.5–1 mm; limb ca. 1 mm, 4-denticulate, sometimes also irregularly splitting. Corolla white or yellow, glabrous outside or sometimes strigose on tube; tube 2–3 mm; lobes elliptic-oblong to narrowly elliptic, 3–4 mm, obtuse. Fruiting pedicels to 8 mm. Berry red, subglobose, 4–9 mm in diam., sparsely strigillose to glabrous; seeds dark red, subovoid, 3–6 × 3–4 mm. Fl. Apr–Aug, fr. May–Feb of following year.

Thickets or forests on hillsides, ravines, fields; near sea level to 1500 m. Anhui, Fujian, Guangdong, Guangxi, Hainan, Hunan, Jiangsu, Jiangxi, Sichuan, Taiwan, Yunnan, Zhejiang [Japan, Vietnam].

This is one of the most commonly collected Rubiaceae species in China.

**2. *Diplospora fruticosa*** Hemsley, J. Linn. Soc., Bot. 23: 383. 1888.

毛狗骨柴 mao gou gu chai

*Discospermum fruticosum* (Hemsley) Kuntze; *Tricalysia fruticosa* (Hemsley) K. Schumann ex E. Pritzel.

Shrubs or trees, 1–8(–15) m tall; branches compressed to terete, densely puberulent to pilosulous or strigillose sometimes becoming glabrescent. Petiole 3–13 mm, strigillose or pilosulous to glabrescent; leaf blade drying papery or thinly leathery, elliptic-oblong, oblong-lanceolate, obovate, oblanceolate, or narrowly elliptic, 5.5–22 × 2.5–8 cm, adaxially glabrous or along principal veins sometimes strigillose to puberulent, abaxially hirtellous to strigillose at least on principal veins, base acute, cuneate, or rarely rounded, sometimes slightly oblique, apex acuminate with tip sometimes curved; secondary veins 7–13 pairs, in abaxial axils usually with well-developed pilosulous domatia; stipules usually deciduous after distalmost 1 or 2 nodes, lanceolate to ovate, 4–8 mm, strigillose or puberulent to glabrescent, acute, keeled in upper part or with ridges in form of upside-down Y, keel extended into arista 0.5–2 mm. Inflorescences shortly cymose, 1–1.5 cm, subsessile, densely puberulent to strigillose; bracts ovate to triangular, 0.5–1 mm, mostly united in pairs; pedicels 0.5–3 mm. Calyx strigillose or puberulent to glabrous; ovary portion obconic to ellipsoid, ca. 1

mm; limb 0.5–1 mm, lobed shallowly or for up to 1/2 its length; lobes broadly triangular. Corolla white or seldom yellow, glabrous outside; tube 2–3.5 mm; lobes oblong-elliptic, ca. 3 mm, obtuse to rounded. Fruiting pedicels to 10 mm. Fruit red, subglobose, 5–7 mm in diam., strigillose to glabrescent; seeds ca. 3 mm. Fl. Mar–May, fr. Jun–Feb of following year.

Thickets or forests in ravines; 200–2000 m. Guangdong, Guangxi, Guizhou, Hubei, Hunan, Jiangxi, Sichuan, Xizang, Yunnan [Vietnam].

**3. *Diplospora mollissima*** Hutchinson in Sargent, Pl. Wilson. 3: 401. 1916.

云南狗骨柴 yun nan gou gu chai

*Tricalysia mollissima* (Hutchinson) Hu.

Shrubs or trees, 2–8 m tall; branches compressed to terete or angled, densely tomentulose or hirtellous. Petiole 4–10 mm, densely tomentulose to glabrescent; leaf blade drying papery or thinly papery, elliptic-oblong, lanceolate, elliptic, or oblong-lanceolate, 5–24 × 2–7.5 cm, adaxially glabrous except midrib and sometimes principal veins tomentulose, abaxially tomentulose or hirtellous on principal veins and hirtellous to glabrous on lamina, base cuneate, obtuse, or rounded, sometimes slightly oblique, apex acute or acuminate with tip often ultimately obtuse; secondary veins 7–10 pairs, in abaxial axils with pilosulous domatia; stipules persistent on distalmost 1–3 nodes, triangular to ovate, 8–10 mm, densely tomentulose to glabrescent, acute or acuminate, keeled in upper part with keel extending into arista 3–6 mm. Inflorescences congested-cymose to glomerulate, 1–1.5 cm in diam., densely strigillose to tomentulose, subsessile; bracts triangular, 0.5–1 mm, often united in pairs; pedicels 0.1–0.5 mm. Calyx strigillose to tomentulose; ovary portion turbinate to obconic, ca. 0.5 mm; limb 1–1.3 mm, undulate to shallowly lobed; lobes broadly triangular. Corolla white, glabrous outside; tube 2–3 mm; lobes oblong-elliptic, 3–3.5 × 1.5–2 mm, obtuse. Fruiting pedicels to 8 mm. Fruit red, subglobose, 5–7 mm in diam., strigillose to glabrescent; seeds 3–4 mm. Fl. May–Jun, fr. Jun–Dec.

• Forests on mountains or at streamsides; 700–1900 m. Yunnan.

**24. *DUNNIA*** Tutchter, J. Linn. Soc., Bot. 37: 69. 1905.

绣球茜属 xiu qiu qian shu

Chen Tao (陈涛); Charlotte M. Taylor

Shrubs, unarmed; branches sometimes rather stout. Raphides present. Leaves opposite, without domatia; stipules persistent, interpetiolar, generally triangular, acute to bifid. Inflorescences terminal, corymbose-cymose, several to many flowered, pedunculate, with peduncles usually elongated and flexuous, bracteate, with some bracteoles on most inflorescences fused to base of hypanthium, expanded, and petaloid thus appearing to be a calycophyll. Flowers subsessile to shortly pedicellate, bisexual, distylous. Calyx limb 4- or 5-denticulate, sometimes 1 or a few flowers with 1 petaloid calycophyll. Corolla yellow, salverform or funnellform, villosulous inside; lobes 4 or 5, valvate in bud. Stamens 4 or 5, inserted in upper part of corolla tube, included or partially exerted; filaments short; anthers apparently dorsifixed. Ovary 2-celled, ovules numerous, position of placentas unknown; stigma 2-lobed, included. Fruit capsular, subglobose to obovoid, apically prolonged into a short beak, stiffly cartilaginous or leathery, septicidally dehiscent into 2 valves with each valve sometimes later splitting into 2 parts, with calyx limb, petaloid bracts, and calycophylls persistent; seeds small, flattened, with marginal wing membranous, irregular or lacerate; endosperm abundant; embryo minute.

Two species: China, India; one species (endemic) in China.

The stipitate petaloid structures on the inflorescence are similar to the petaloid calycophylls of other Rubiaceae genera; however, these appear to

comprise two different morphological structures. Most of these structures appear to be inserted at the base of the ovary and thus can be considered bracts, but some appear to be enlarged calyx lobes inserted above the ovary.

*Dunnia* was revised by Ridsdale (Blumea 24: 367–368. 1979).

**1. *Dunnia sinensis*** Tutch. J. Linn. Soc., Bot. 37: 70. 1905.

绣球茜草 *xiu qiu qian cao*

Shrubs, 0.3–2.5 m tall; branches rather stout, subterete to angled, puberulent to pilosulous sometimes becoming glabrescent with age. Petiole 0.7–2.5 cm, pilosulous or puberulent; leaf blade drying papery to leathery, narrowly lanceolate, narrowly elliptic, or oblanceolate, 7–23 × 1–6 cm, both surfaces puberulent to strigillose with pubescence denser on principal veins, sometimes becoming glabrescent with age, abaxially epidermis often with apparently enlarged cells, base acute to cuneate, margins often thinly revolute, apex acuminate, acute, or rarely obtuse; secondary veins 11–17 pairs, extending to very close to margins, with intersecondary veins often very well developed; stipules ovate or triangular, 6–8 × 8–10 mm, strigillose to puberulent, acute or often bifid for up to 1/3. Inflorescences 8–12 × 3–5 cm, moderately to densely strigillose or pilosulous; peduncle 2–6 cm; branched portion 2–4 × 3–5 cm; bracts trian-

gular, 1–1.5 mm, petaloid bracts similar to calycophylls; pedicels to 3 mm. Calyx sparsely to densely puberulent or strigillose; ovary portion obconic, 1–1.5 mm; limb deeply lobed; lobes deltoid, 0.3–0.5 mm; petaloid calycophyll white to cream, elliptic-oblong to lanceolate, 2–5.5 × 1–2.3 cm, puberulent to glabrescent, obtuse to rounded, with 3 longitudinal veins and well-developed reticulate venation, with stipe 0.8–1.5 cm. Corolla outside sparsely to densely pilosulous or puberulent; tube 8–10 mm; lobes triangular-ovate, ca. 2 mm, acute to obtuse. Capsule 3–5 mm in diam. including beak ca. 1 mm, smooth, pilosulous to glabrescent; seeds 0.6–1 mm in diam. Fl. and fr. Apr–Nov.

- Thickets or forests in ravines; 200–900 m. Guangdong.

In conservation status, this species has been considered seriously threatened due primarily to habitat destruction (Ge et al., Conservation Genet. 3: 351–362. 2002; Chiang et al., Molec. Biol. Evol. 19: 1367–1375. 2002).

**25. *DUPERREA*** Pierre ex Pitard in Lecomte, Fl. Indo-Chine 3: 334. 1924.

长柱山丹属 *chang zhu shan dan shu*

Chen Tao (陈涛); Charlotte M. Taylor

Shrubs or small trees, unarmed. Raphides absent. Leaves opposite or sometimes markedly anisophyllous and apparently ternate due to reduced internodes grouping 2 leaves at 1 node and an apparently single leaf produced on a single very short axillary branch, without domatia or these few, pilosulous, and rudimentary; stipules persistent, interpetiolar or sometimes shortly united around stem, triangular, acuminate to aristate. Inflorescence terminal on principal branches or on reduced axillary branches, quickly becoming overtopped by growth of 1 or 2 axillary branches thus appearing axillary or sometimes with subtending leaf caducous and then appearing pseudoaxillary, corymbiform, many flowered, pedunculate, bracteate. Flowers pedicellate, bisexual, monomorphic. Calyx limb deeply 5(or 6)-lobed. Corolla white, salverform with tube slender, glabrous inside; lobes 5(or 6), convolute in bud. Stamens 5(or 6), inserted in corolla throat, partially exserted; filaments reduced; anthers dorsifixed, bifid at base, with connective prolonged apically into a short conical appendage. Ovary 2-celled, ovules 1 in each cell on peltate axile placentas; stigma subglobose to ellipsoid, long exserted. Fruit black, drupaceous but sometimes appearing baccate, compressed subglobose to somewhat didymous, fleshy, with calyx limb deciduous; pyrenes 2, 1-celled, with 1 seed, plano-convex to oblate, papery or cartilaginous; seeds medium-sized, oblate or concave on ventral face; endosperm corneous; embryo small; cotyledons ovate; radicle basiscopic.

Two species: Cambodia, China, India, Laos, Myanmar, Thailand, Vietnam; one species in China.

Puff et al. (Rubiaceae of Thailand, 88. 2005) observed that *Duperrea pavettifolia* is quite variable morphologically and suggested that this genus probably comprises only one variable species.

**1. *Duperrea pavettifolia*** (Kurz) Pitard in Lecomte, Fl. Indo-Chine 3: 334. 1924 [*“pavettaefolia”*].

长柱山丹 *chang zhu shan dan*

*Mussaenda pavettifolia* Kurz, Forest Fl. Burma 2: 57. 1877 [*“pavettaefolia”*]; *Ixora pavettifolia* (Kurz) Craib.

Erect shrubs to small trees, 1.5–6 m tall; branches slightly compressed, strigillose to strigose. Petiole 3–8 mm, strigillose; leaf blade drying membranous to papery, oblanceolate to obovate, elliptic, or elliptic-oblong, 7–25 × 3–8.5 cm, adaxially glabrous to puberulent, abaxially puberulent on blade and strigillose along veins, base cuneate to obtuse or rounded, apex acuminate; secondary veins 7–12 pairs; stipules ovate, 6–10

mm, strigillose to strigose, acuminate to shortly aristate. Inflorescence densely strigillose, hirsute, or strigose; peduncle 1–2.5 cm; branched portion 2–5 × 2.5–6 cm; bracts linear, 1.5–5 mm; pedicels 3–5 mm. Calyx densely hirsute to strigillose; ovary portion cylindrical to obconic, ca. 1 mm; limb with basal tubular portion 1–2 mm; lobes linear, 4–5 mm, acuminate. Corolla densely strigillose outside; tube 16–20 × 1.5–2 mm; lobes oblong-elliptic to elliptic or suborbicular, 4–5 mm, obtuse to rounded. Fruit 7–10 × 10–12 mm; pyrenes 5–6 × 5–6 mm, smooth to shallowly ridged. Fl. Apr–Jun, fr. Sep–Dec.

Broad-leaved forests at low to middle elevations; 100–1100 m. Guangxi, Hainan, Yunnan [Cambodia, Laos, Myanmar, Thailand, Vietnam].

**26. EMMENOPTERYS** Oliver, Hooker's Icon. Pl. 19: t. 1823. 1889.香果树属 *xiang guo shu shu*

Chen Tao (陈涛); Charlotte M. Taylor

Trees, unarmed. Raphides absent. Leaves opposite, with domatia; stipules caducous, interpetiolar, triangular, acute. Inflorescences terminal, corymbose to paniculiform, many flowered, pedunculate, bracteate with bracts reduced. Flowers pedicellate, bisexual, monomorphic, fragrant. Calyx limb 5-lobed nearly to base, with lobes imbricate in bud, some flowers of most inflorescences with 1 lobe expanded into a white petaloid calycophyll. Corolla white or yellow, funnelliform with tube notably narrowed near base, glabrous inside; lobes 5, imbricate in bud. Stamens 5, inserted below corolla throat, included; filaments developed, tomentose; anthers dorsifixed, included. Ovary 2-celled, ovules numerous in each cell on peltate axile placentas; stigma capitate or shallowly 2-lobed, included. Fruit capsular, oblong-cylindrical to fusiform with disk portion shortly prolonged into a rounded beak, septicidally dehiscent from apex in apical half, woody, with calyx limb deciduous except with calycophyll sometimes persistent; seeds numerous, medium-sized, fusiform, flattened, winged; testa spongy, reticulate-areolate; albumen rich; embryo minute; cotyledons cylindrical.

- One species: China.

*Emmenopterys* is currently known only from moist temperate E Asia, with its range wholly inside China, but fossils of the genus are known from W North America; Latham and Ricklefs (in Ricklefs & Schluter, Spec. Diversity Ecol. Communities, 294–314. 1993) discussed the biogeography and putative history of this distribution.

*Emmenopterys henryi* is considered a rare species of conservation concern in China. Its habitat, population status, and distribution were studied by Chen et al. (Acta Bot. Yunnan. 29: 461–466. 2007) in one site, where the population appears to be declining; additional studies are cited there, and its classification as a Grade II Chinese National Protected Wild Plant was reviewed by Liu (Gansu Sci. Technol. 19(10): 151–152. 2003).

**1. Emmenopterys henryi** Oliver, Hooker's Icon. Pl. 19: t. 1823. 1889.香果树 *xiang guo shu**Mussaenda cavaleriei* H. Léveillé; *M. mairei* H. Léveillé.

Trees, deciduous, to 30 m tall, to 1 m d.b.h., with grayish brown bark; branches angled to terete, often lenticellate, rather stout, glabrous. Petiole 20–80 mm, glabrous to hirtellous or strigillose; leaf blade drying papery or leathery and paler below, broadly elliptic, broadly ovate, or ovate-oblong, 6–30 × 3.5–14.5 cm, adaxially glabrous or sparsely strigose, abaxially glabrous to strigillose or hirtellous throughout or only on principal veins, base acute to cuneate or obtuse, apex acute, abruptly acuminate, or rarely obtuse; secondary veins 5–9 pairs, in abaxial axils with pilosulous domatia; stipules triangular-ovate, 6–10

mm, acute. Inflorescences hirtellous to glabrous; peduncle 2.5–5.5 cm; branched portion 5–18 × 6–20 cm; bracts caducous, narrowly triangular, 1–8 mm, acute; pedicels 1.5–5 mm. Calyx puberulent to usually glabrous; ovary portion ellipsoid, 3–4 mm; lobes suborbicular, 2–2.2 mm, ciliate, rounded; calycophyll white, pink, or pale yellow, blade drying papery or leathery, spatulate to broadly elliptic or ovate, 1.5–8 × 1–6 cm, parallel veined, on stipe 1–3 cm. Corolla outside densely tomentulose; tube 13–23 mm, narrow at base then quickly dilated near middle; lobes suborbicular, 5–7 mm, densely ciliate, rounded. Capsules 3–5 × 1–1.5 cm, smooth or longitudinally weakly ribbed; seeds 6–8 × 1.5–2 mm, broadly winged. Fl. Jun–Aug, fr. Aug–Nov.

- Forests in valleys; 400–1600 m. Anhui, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Shanxi, Sichuan, Yunnan, Zhejiang.

**27. FOSBERGIA** Tirvengadam & Sastre, Biogeographica (Paris) 73(2): 88. 1997.大果茜属 *da guo qian shu*

Chen Tao (陈涛); Charlotte M. Taylor

Trees or shrubs, unarmed; bark gray or reddish brown and scaly. Raphides absent. Leaves opposite but sometimes crowded at stem apices, often with domatia; stipules generally persistent, interpetiolar or shortly united around stem, triangular. Inflorescences terminal or displaced to pseudoaxillary, 2–7-flowered and cymose or reduced to 1 flower, pedunculate, bracteate. Flowers subsessile to pedicellate, apparently bisexual and monomorphic. Calyx limb shallowly 5-lobed. Corolla white, salverform, fleshy to leathery, inside variously pubescent; lobes 5, convolute in bud. Stamens 5, inserted in corolla throat, included; filaments short; anthers perhaps dorsifixed. Ovary 2-celled, ovules numerous in each cell on axile placentas; stigma fusiform to clavate, shallowly bilobed, partially exerted. Fruit baccate, thickly fleshy, globose to ellipsoid, smooth or infrequently ridged or tuberculate, color at maturity unknown, with calyx limb tardily deciduous; seeds numerous, medium-sized to large, broadly angled, ovoid, or compressed, embedded in pulp.

- At least five species: China, Myanmar, Thailand, Vietnam; three species (one endemic) in China.

Tirvengadam and Sastre (loc. cit.: 87–94) implied without directly stating so that the flowers are hermaphroditic, and Puff et al. (Rubiaceae of Thailand, 62. 2005) reported this condition tentatively. The pollen is reportedly “simple, 3-porate”; the ovary wall contains “crystal sands present in small clusters in mesocarp”; and the testa cells have “tube-like trabecular thickenings, [with] inner wall irregularly thickened.”

- 1a. Stems strigillose at least when young; leaves elliptic to oblong-elliptic, lanceolate-oblong, or oblanceolate, 9.5–15 × 2–4.5 cm; stipules keeled or ornamented throughout their length, with a straight median keel or sometimes a ridge and/or line of pubescence in shape of an upside-down Y; calyx margins uniform, similar in texture to rest of limb; fruit ca. 11 × 9 cm ..... 2. *F. shweliensis*
- 1b. Stems glabrous; leaves oblanceolate to obovate or broadly obovate, 10–24 × 3.5–12 cm; stipules smooth or keeled only in upper half, glabrous in lower half; calyx margins uniform to hyaline; fruit 4–6 × 4–5 cm.
- 2a. Leaves obovate to oblanceolate, with domatia in abaxial vein axils; flowers 3–5 in cymes, with developing fruit solitary; calyx limb with margins hyaline and lobes aristate ..... 1. *F. petelotii*
- 2b. Leaves broadly obovate, without domatia; flowers solitary; calyx limb with margins uniform and lobes acute but tips not prolonged ..... 3. *F. thailandica*

**1. *Fosbergia petelotii*** Merrill ex Tirvengadam & Sastre, Biogeographica (Paris) 73(2): 89. 1997.

中越大果茜 zhong yue da guo qian

Trees, 6–10 m tall; bark reddish brown; branches compressed to terete, glabrous. Petiole 5–10 mm, strigose; leaf blade drying papery, oblanceolate to obovate, 10–24 × 3.5–7 cm, adaxially glabrous, abaxially strigose at least on veins, base cuneate to acute, apex acuminate to long acuminate; secondary veins 8–11 pairs, in abaxial axils with pilosulous domatia; stipules triangular, 4–7 mm, glabrous, abaxially keeled in upper half, acute and aristate, arista 2–3 mm. Inflorescences 3–15-flowered, glabrous; peduncle 0.5–1 cm; bracts triangular to sub-orbicular, 1–3 mm; pedicels 8–15 mm. Calyx glabrous; ovary portion obovoid to ellipsoid, ca. 4 mm; limb 10–15 mm, lobed for ca. 1/2; lobes triangular to narrowly triangular, marginally hyaline, acute and aristate, arista 1–2 mm. Corolla white, outside apparently glabrous; tube 6–14 mm, inside glabrescent or sparsely hairy at base; lobes narrowly triangular, 13–17 mm. Stigmas ca. 3 mm. Berries solitary, globose to ovoid-globose, 4–6 × 4–5 cm, sparsely to rather densely tuberculate or perhaps smooth at least when young; seeds orbicular, laterally compressed, 6–8 × 5–6 × 2.5–3 mm, bony. Fl. Mar–Apr.

Evergreen forests on mountain slopes or in valleys; 1400–1900 m [as low as 1100–1200 m in Vietnam]. Yunnan (Jinping, Lüchun, Maguan) [Vietnam].

Zhang et al. (Acta Phytotax. Sin. 45: 90–93. 2007) noted that the Chinese plants differ from the Vietnamese plants in having leaf blades glabrous adaxially and hairy along the veins abaxially and corolla tubes 1–1.4 cm (vs. glabrous on both surfaces and corolla tube up to 6 mm in the Vietnamese plants).

**2. *Fosbergia shweliensis*** (J. Anthony) Tirvengadam & Sastre, Biogeographica (Paris) 73(2): 88. 1997.

瑞丽茜树 rui li qian shu

*Randia shweliensis* J. Anthony, Notes Roy. Bot. Gard. Edinburgh 18: 205. 1934; *Aidia shweliensis* (J. Anthony) W. C. Chen.

Trees, 8–20 m tall; branches angled to terete, strigillose becoming glabrescent. Petiole 5–10 mm, sparsely strigillose to glabrous; leaf blade drying papery, elliptic to oblong-elliptic, lanceolate-oblong, or oblanceolate, 9.5–15 × 2–4.5 cm, adaxially glabrous, abaxially sparsely strigillose or strigose along principal veins, base cuneate to acute and sometimes slightly inequilateral, apex shortly acuminate to acuminate; secondary

veins 8–11 pairs, usually with pilosulous domatia in abaxial axils; stipules triangular to ovate, 5–10 mm, keeled or with ridges in upside-down-Y pattern, strigillose, slenderly acute, sometimes with 1 or 2 aristae 1–3 mm. Inflorescences 2–10-flowered, strigillose to strigose or glabrescent; peduncle 1–1.5 cm; bracts linear-lanceolate, 2–4 mm, aristate; pedicels 6–18 mm. Calyx glabrous; ovary portion obovoid to ellipsoid, 3–4 mm; limb 8–13 mm, inside villosulous to tomentulose, lobed for ca. 1/3; lobes triangular to linear-lanceolate, acute and terminating in arista 1–2 mm. Corolla creamy white to pale green or pale yellow, outside glabrous; tube 20–25 mm, inside tomentose; lobes lanceolate, 15–26 mm, acuminate to subaristate, marginally hyaline. Fruiting peduncle to 3.5 m. Berry subglobose to ellipsoid, ca. 11 × 9 cm, smooth; seeds ovoid to oblong-angular, ca. 12 × 7 mm. Fl. May–Jun, fr. May.

• Open thickets or sparse moist primary broad-leaved forests in valleys; 1100–2200 m. W Yunnan.

Li et al. (Acta Phytotax. Sin. 44: 707–711. 2006) illustrated this species in their figure 1 and reported that the flower buds are formed nearly a year before the flowers open and that the fruit may take two years to mature. They also detailed errors in the localities of Chinese specimens given by Tirvengadam and Sastre in their protologue and excluded one of the specimens treated by them, *C. W. Wang 78281* (A), which they included instead in *Fosbergia thailandica*. Additionally, they reported that the Gaoligong Shan population of this species does not appear to be reproducing itself, although they stop short of considering this a species of conservation concern.

**3. *Fosbergia thailandica*** Tirvengadam & Sastre, Biogeographica (Paris) 73(2): 89. 1997.

泰国大果茜 tai guo da guo qian

Trees; bark thin, exfoliating in small pieces, grayish or brownish on older parts when dry; branches glabrous. Petiole to 2 cm, glabrous; leaf blade broadly obovate, 14–23 × 4–12 cm, both surfaces glabrous except abaxially strigose on principal veins, base acute to attenuate, apex acuminate to long acuminate; secondary veins 8–11 pairs, without domatia; stipules ovate, 5–10 mm, glabrous, smooth at base and keeled in upper part, obtuse to acute and aristate, arista ca. 2 mm. Flowers solitary. Calyx glabrous; ovary portion obovoid, ca. 1 cm; limb 3–5 mm, deeply lobed; lobes narrowly triangular. Corolla not seen. Fruiting peduncle ca. 2.5 cm. Immature berry globose, 4–5 cm in diam., glabrous, smooth.

Valleys, mixed woods, lower montane evergreen forests; 1500–1900 m. Yunnan (Jinghong) [N Thailand (Nan)].

**28. GALIUM** Linnaeus, Sp. Pl. 1: 105. 1753.拉拉藤属 *la la teng shu*

Chen Tao (陈涛); Friedrich Ehrendorfer

Subshrubs to perennial or annual herbs. Stems often weak and clambering, often notably prickly or “sticky” (i.e., retrorsely aculeolate, “velcro-like”). Raphides present. Leaves opposite, mostly with leaflike stipules in whorls of 4, 6, or more, usually sessile or occasionally petiolate, without domatia, abaxial epidermis sometimes punctate- to striate-glandular, mostly with 1 main nerve, occasionally triplinerved or palmately veined; stipules interpetiolar and usually leaflike, sometimes reduced. Inflorescences mostly terminal and axillary (sometimes only axillary), thyrsoid to paniculiform or subcapitate, cymes several to many flowered or infrequently reduced to 1 flower, pedunculate to sessile, bracteate or bracts reduced especially on higher order axes [or bracts sometimes leaflike and involucre], bracteoles at pedicels lacking. Flowers mostly bisexual and monomorphic, hermaphroditic, sometimes unisexual, andromonoecious, occasionally polygamo-dioecious or dioecious, pedicellate to sessile, usually quite small. Calyx with limb nearly always reduced to absent; hypanthium portion fused with ovary. Corolla white, yellow, yellow-green, green, more rarely pink, red, dark red, or purple, rotate to occasionally campanulate or broadly funnelform; tube sometimes so reduced as to give appearance of free petals, glabrous inside; lobes (3 or)4(or occasionally 5), valvate in bud. Stamens (3 or)4(or occasionally 5), inserted on corolla tube near base, exerted; filaments developed to  $\pm$  reduced; anthers dorsifixed. Inferior ovary 2-celled,  $\pm$  didymous, ovoid, ellipsoid, or globose, smooth, papillose, tuberculate, or with hooked or rarely straight trichomes, 1 erect and axile ovule in each cell; stigmas 2-lobed, exerted. Fruit on pedicels sometimes elongating during development, green, gray, or infrequently white (to red, orange, or black), mostly dry to leathery schizocarps, infrequently spongy, rarely  $\pm$  fleshy and berrylike, ellipsoid to subglobose; schizocarps separating into 2 indehiscent mericarps, each with 1 seed, subglobose, ellipsoid-oblong, or reniform, smooth and glabrous to tuberculate and/or covered with trichomes often hooked and clinging; seeds small, grooved ventrally (i.e., adaxially); testa membranous; endosperm corneous; embryo curved; cotyledons leaflike; radicle terete, inferior.

More than 600 species: worldwide, mostly in meridional to temperate but also in alpine and arctic regions or in subtropical and tropical zones at higher elevations; 63 species (23 endemic, four of unconfirmed occurrence) in China.

*Galium* is by far the largest and most widespread genus within the tribe Rubieae (subfamily Rubioideae). According to the most recent contributions (Natali et al., *Opera Bot. Belg.* 7: 193–203. 1996; Ehrendorfer et al., *Fl. Iranica* 176: 1–287. 2005; Bremer & Eriksson, *Int. J. Pl. Sci.* 170: 766–793. 2009; Soza & Olmstead, *Taxon* 59: 755–771. 2010), this tribe is closest to Theligoneae, Putorieae, and Paederieae, and includes the following genera treated (or mentioned) in the present flora: *Asperula*, *Cruciata* Miller, *Galium*, *Kelloggia*, *Leptunis*, *Microphysa*, *Phuopsis*, *Rubia*, and *Sherardia* Linnaeus.

So far, the genera *Cruciata* and *Sherardia* have not been found in China yet but may be expected there because of their partly weedy character and widely adventive occurrence. They are included in the key below for future reference but not among the full generic presentations. *Sherardia arvensis* Linnaeus is widely distributed in warm temperate and high-elevation tropical regions and can be separated from *Asperula*, *Phuopsis*, *Leptunis*, or *Galium* by its terminal capitate inflorescences enclosed by leaflike bracts, its clearly developed calyx with 6 acute lobes, and its pink or violet corollas with well-developed funnelform tubes and 4 lobes.

Among the few *Cruciata* species, the W Eurasiatic *C. pedemontana* (Bellardi) Ehrendorfer appears occasionally as an adventive in warm temperate regions. It is common, e.g., in SE North America, and could be found in China too. *Cruciata* can be separated from *Galium* by its flowering stems with vegetative apices and the inflorescences consisting only of lateral axillary cymes on middle and lower stem nodes. These cymes are equal to or shorter than the subtending leaves when fully developed. In contrast, the inflorescences are mostly terminal and axillary and longer than the leaves in *Galium*.

The characters relevant for the taxonomy of *Galium* and other Rubieae deserve some comments. Life and growth forms are important, particularly with respect to the differentiation into half-shrubs, herbaceous perennials, and annuals. Stem and leaf posture, consistency, shape, and indumentum (e.g., pubescent or retrorsely aculeolate with recurved microhairs) are often quite diverse and may vary within species or even populations. The true leaves are always opposite and 2, but interpetiolar stipules may vary from inconspicuous and divided or simple to enlarged and leaflike, forming whorls of 4 or up to 6 and more. During seedling and shoot development all these taxa pass through the 2- and 4-whorl stage, but some taxa remain at this stage, while others continue to develop more numerous whorl elements toward the middle of their stems. This is a most informative differential character within Rubieae. Other relevant features relate to leaf shape, venation, texture, and particularly indumentum. Here, the presence of longer or shorter microhairs (use a lens) on surfaces and particularly margins as well as their forward or backward direction is of taxonomic importance.

Other morphological characters decisive for Rubieae taxonomy concern the inflorescences (e.g., the position and structure of the cymes). Flower shape is essential for the traditional separation of the genera *Asperula* (with salverform, funnelform, or cup-shaped corollas) and *Galium* (with  $\pm$  rotate corollas). It is now clear that there are transitions between these character states and that even closely related taxa may differ in this respect. So far, it has been possible to provisionally maintain *Asperula* and *Galium* by the transfer of obviously misplaced taxa and by using the presence or absence of bracts and bracteoles as a differential character for the two genera (see Ehrendorfer et al., loc. cit. 2005).

The indumentum of ovaries and fruit as well as fruit consistency also vary strongly within Rubieae. Informative are, for example,  $\pm$  fleshy berries (as in *Relbunium* Benthham & J. D. Hooker, *Rubia*, and certain *Galium* taxa) vs. dry schizocarps or the presence vs. absence of hairiness and whether the trichomes are hooked (i.e., the fruit disperse as “stick-tights” on animals) vs. straight. However, the distinction between all these structures is arbitrary, and there are even transitions between trichomes and tuberculate protuberances of various shapes as well as between hairy and glabrous.

All this is well illustrated by Yang and Li (Bull. Natl. Mus. Nat. Sci., Taichung 11: f. 1. 1998). Furthermore, ovary and fruit indumentum and surface structures may change during development and sometimes vary genetically within species or even within populations, as in several *Galium* species. In general, authors in other regions have documented infraspecific variation from glabrous to densely hairy or tuberculate fruit but traditionally have only separated plants with hooked trichomes into different species. However, intrepid Chinese authors have easily combined these latter morphotypes, e.g., in *G. dahuricum* sensu W. C. Chen (in FRPS 71(2): 255. 1999), whereas Fl. Japan (3a: 238–239. 1993) distinguished *G. manshuricum* on the basis of this character. Only careful studies and field observations can clarify such cases, as in *G. spurium*, where the infraspecific variation of fruit, either smooth, tuberculate, or covered with hooked hairs, has been proven.

Further differential characters for the taxonomy of Rubieae come from the fields of palynology (e.g., number of colpi), karyology (e.g., deviations from the normal chromosome base number  $x = 11$  in *Asperula* sect. *Cynanchicae* (Candolle) Boissier with  $x = 10$  or in *Galium* sect. *Aparinoides* (Jordan) Grenier with  $x = 12$ ; common occurrence of polyploidy), and reproductive biology. Most of the perennial Rubieae taxa have conspicuous hermaphroditic or andromonoecious flowers and inflorescences and are insect-pollinated and self-incompatible outbreeders (e.g., *Phuopsis* or *G. boreale* and *G. verum*). Nevertheless, for several annuals with small and inconspicuous flower aggregates selfing and autogamy have been documented (e.g., *G. aparine*, *G. spurium*, and *Sherardia arvensis*). Furthermore, polygamodioecy and dioecy occur in some groups (e.g., *G. elegans*). Up to now, only few and insufficient data from all these fields are available for Asian Rubieae species and have not been mentioned in FRPS. Nevertheless, such data are significant and will have to be addressed in more detailed future systematic Rubieae studies from this region.

The  $\alpha$ -taxonomy of Rubieae in E Asia is still in a problematic state. A general survey of the collections at the herbaria KUN, MO, PE, W, and WU has revealed the existence of many very polymorphic, complex, and insufficiently understood species groups. Therefore, the present treatment has to be regarded as provisional.

A particularly critical case concerns several *Galium* species described by H. Léveillé from 1904–1917 (see Lauener & Ferguson, Notes Roy. Bot. Gard. Edinburgh 32: 103–115. 1973). These descriptions are most fragmentary and the relevant types are not yet studied sufficiently (but see Mill, Edinburgh J. Bot. 53: 193–213. 1996). Relevant taxa in alphabetical order are *G. blinii* (see under that name), *G. bodinieri* (see under *G. blinii* and *G. rebae*), *G. cavaleriei* (see under *G. asperifolium*), *G. comarii* (see under *G. dahuricum*), *G. esquirolii* (see under *G. asperifolium*), *G. hongnoense* (see under *G. spurium*), *G. mairei* (see under *G. elegans*), *G. martini* (see under *G. bungei*), *G. quinatum* (see under *G. blinii*), *G. remotiflorum* (see under *G. bungei*), and *G. venosum* (see under *G. bungei*).

The treatment of *Galium* for the *Flora of Taiwan* by Yang and Li (Bull. Natl. Mus. Nat. Sci., Taichung 11: 101–117. 1998; Fl. Taiwan, ed. 2, 4: 254–259. 1998) is not satisfactory in several aspects: keys and descriptions are rather idealized and lack carefully observed ranges of morphological variation for the taxa; species are circumscribed more narrowly and based on different characters than used by other authors in the region (e.g., presence vs. absence of leaf indumentum is considered variable within species by most other authors); the treatment is not well reconciled with continental *Galium* taxonomy (e.g., there are no references to the Russian floras, and names synonymized by others are used without explanation); and at least two names based on types from Taiwan are missing.

With respect to a more “natural” and general taxonomic classification of the Rubieae and *Galium*, a number of recent morphological, karyological, palynological, and particularly DNA-analytical studies (e.g., Natali et al., loc. cit.; Robbrecht & Manen, Syst. & Geogr. Pl. 76: 85–146. 2006; Bremer & Eriksson, loc. cit.; Soza & Olmstead, loc. cit.) are available. They show that *Theligonum* should be placed into a separate tribe (Theligoneae), that the tribe Rubieae is monophyletic, and that *Kelloggia* (as subtribe Kelloggiinae, still with normal Rubiaceae stipules, calyx teeth, and 3-colpate pollen, but already with hooked trichomes on the dry mericarps) occupies a basal position in Rubieae. The Central American genus *Didymaea* J. D. Hooker (still with normal stipules but with the calyx already lacking, 5-colpate pollen, and seeds separating from the fleshy pericarp) represents a link to the genus *Rubia* in the true Rubiinae. Their stipules are nearly always leaflike, the pollen is polycolpate, and the seeds never separate from the pericarp. *Rubia*, a well-circumscribed and certainly monophyletic genus, is always perennial, has 5-lobed corollas, and berrylike fruit.

The remaining Rubiinae are also monophyletic as a whole, but their traditional genera *Asperula*, *Bataprine* Nieuwland, *Callipeltis* Steven, *Crucianella* Linnaeus, *Cruciata*, *Galium*, *Leptunis*, *Mericarphaea* Boissier, *Microphysa*, *Phuopsis*, *Relbunium*, *Sherardia*, *Valantia* Linnaeus, and *Warburgina* Eig are all essentially interdigitated. They are difficult to separate and can hardly be brought into concordance with available phylogenetic data. These advanced Rubiinae tend to develop more and more apomorphic character profiles, i.e., change from perennial to annual, increase in numbers of leaflike stipules from 4 to numerous, loss of bracts and prophylls in the inflorescences, reduction from 5-lobed to (3 or) 4-lobed corollas, specialization of mericarps, etc. As shown by the most comprehensive phylogram available so far (Natali et al., loc. cit.: f. 2; Soza & Olmstead, loc. cit.: f. 1, 2) and new findings (unpubl.), these more apomorphic Rubiinae form a polytomy or a grade with seven parallel clades. The most basal clade (1) consists of the monotypic *Galium* sect. *Cymogalia* Pobedimova only. The following *Sherardia* clade (2) includes *Crucianella*, *Phuopsis*, *Sherardia*, and several sections of *Asperula* together with *Leptunis*. Separate clades are formed by *G.* sect. *Depauperata* Pobedimova (3), *A.* sect. *Glabella* Grisebach, including *G.* sect. *Aparinoides* (4), and *A.* sect. *Asperula* (5). The *Cruciata* clade (6) consists not only of the genera *Cruciata* and *Valantia* but also of all sections of *Galium* (including the traditional genera *Bataprine*, *Microphysa*, and *Relbunium*) that form whorls of 2 leaves and normally not more than 2 even-sized leaflike stipules. Finally, the *G.* sect. *Galium* clade (7) comprises this and various other sections of *Galium*, which regularly develop whorls of leaves and leaflike stipules with 5 to more elements.

From the above data and the fact that a number of major groups of Rubiinae have not been DNA-analyzed yet, it is obvious that it is still difficult and partly impossible to harmonize DNA-supported clades with the traditional genera and sections. Thus, extensive changes are expected for generic and sectional circumscriptions within Rubiinae in the future. Therefore, we refrain from taxonomic changes for the present flora, list taxa in alphabetical order, and only supplement phylogenetic comments. Thus, the present treatment in principle follows FRPS (71(2): 216–286. 1999), mainly based on Pobedimova et al. (Fl. URSS 23: 287–381. 1958), but also considers Ehrendorfer et al. (loc. cit. 2005). In order to make comparison with available phylogenetic data and present infrageneric classification easier, relevant information is inserted as a “Taxonomic Conspectus” before the individual species descriptions. It was not until this volume was ready for the press that the need for the nomen novum, *Galium glabriusculum*, was discovered; therefore, this species alone is outside of the alphabetical order.

Here the key to species of *Galium* is extensively revised from that of FRPS. It includes all of the Chinese *Galium* species with full ranges of differential character variation. Furthermore, it keys out all other Rubiaceae genera which are easily confused with *Galium* and are documented or can be expected in China. Details on the genera *Asperula*, *Leptunis*, *Microphysa*, *Phuopsis* and *Rubia* can be found where they are listed in alphabetical order, references to *Cruciata* and *Sherardia* appear in the comments above.

Several species are keyed out more than once in the present key because they are circumscribed by combinations of characters rather than by unique features. Furthermore, many *Galium* species are markedly variable because of genetic differentiation (e.g., *G. bungei*, *G. elegans*) but also because of phenetic plasticity due to different environmental conditions. References to the number of leaves and leaflike stipules in whorls as well as leaf measurements refer to middle stem regions. Measurements of organs with hairy surfaces (e.g., leaves, fruit, and mericarps) here apply to the solid surface of the structure and do not include the trichomes. The terms “leaf whorl,” “ovary,” and “uncinate trichome” follow common usage in *Galium*. Intraspecific taxa are adopted from FRPS in order to facilitate future and more detailed work on this group and comparison with other floras. They are not included in the following main key but are subordinated under the relevant species in alphabetical order and keyed out there.

### Taxonomic conspectus of the Rubieae (excluding *Kelloggia* and *Rubia*)

In FRPS (71(2): 216–286. 1999) the taxa of *Galium* were placed in the following sections (designated here by capital letters): *G.* sect. *Depauperata* (A), *G.* sect. *Aparine* (B), *G.* sect. *Pseudaparine* Lange (C), *G.* sect. *Cymogalia* (D), *G.* sect. *Trachygaliaceae* (E), *G.* sect. *Leptogaliaceae* Lange (F), *G.* sect. *Platygalium* (G), *G.* sect. *Galium* (H), *G.* sect. *Leiogalium* (I), *G.* sect. *Trichocarpa* (Pobedimova) Pobedimova (J), *G.* sect. *Asperuloides* Pobedimova (K), and *G.* sect. *Brachyantha* (Boissier) Pobedimova (L). Some species of uncertain position were classified as dubious (M). Species accepted in the present treatment but lacking in FRPS are designated as (Z). For comparison, a current (e.g., Jelenevsky et al., *Novosti Sist. Vyssh. Rast.* 35: 174–187. 2003; Ehrendorfer et al., *Fl. Iranica* 176: 1–287. 2005), DNA-analytically supported (e.g., Natali et al., *Opera Bot. Belg.* 7: 193–203. 1996; Soza & Olmstead, *Taxon* 59: 755–771. 2010; Ehrendorfer, unpubl.) but still provisional taxonomic conspectus is presented below. It lists all species here accepted under their clades and sections. For the clades 1–6 one should compare the comments above, for the sections compare Ehrendorfer et al. (loc. cit.). The placement of *Galium* species into sections (or lack of placement) by FRPS is indicated by showing the relevant letters used above in parentheses after the species names.

#### Clade 1

*Galium* sect. *Cymogalia* Pobedimova s.s.

39. *Galium paradoxum* (D)

#### Clade 2

- Phuopsis stylosa*  
*Sherardia arvensis*  
*Leptunis trichodes*  
*Asperula oppositifolia*

#### Clade 3

*Galium* sect. *Depauperata* Pobedimova

16. *Galium exile* (A; incl. *G. songaricum* sensu FRPS)

#### Clade 4

*Galium* sect. *Aparinoides* (Jordan) Grenier

27. *Galium karakulense* (E)  
25. *Galium innocuum* (as *G. trifidum*: E; incl. “*G. palustre*”)

#### Clade 5

*Asperula* sect. *Asperula*

- Asperula orientalis*

#### Clade 6

*Galium* sect. *Platygalium* W. D. J. Koch s.l.

9. *Galium bungei* (E; incl. *G. martini*: M)  
45. *Galium salwinense* (E)  
12. *Galium crassifolium* (A)  
31. *Galium linearifolium* (E)  
21. *Galium hirtiflorum* (Z)  
20. *Galium glandulosum* (A)  
18. *Galium forrestii* (D)  
44. *Galium rupifragum* (Z)  
35. *Galium morii* (D)  
54. *Galium tarokoense* (A)  
34. *Galium minutissimum* (M)

36. *Galium nankotaizanum* (M; incl. *G. maborasense*)

47. *Galium serpylloides* (A)  
29. *Galium kinuta* (G)  
24. *Galium hupehense* (M)  
30. *Galium kunningense* (Z)  
17. *Galium formosense* (as *G. kwanzanense*: M)  
15. *Galium elegans* (D)  
63. *Galium yunnanense* (M)  
26. *Galium kamtschaticum* (D)  
10. *Galium chekiangense* (as *G. nakaii*: G)  
*Microphysa elongata*  
40. *Galium platygalium* (K)  
32. *Galium maximoviczii* (K)  
7. *Galium boreale* s.l. (G)  
60. *Galium turkestanicum* (M)

#### Clade 7

[*Galium* s.s.]

*Galium* sect. *Hylaea* (Grisebach) Ehrendorfer s.l.

37. *Galium odoratum* (J)  
4. *Galium asperuloides* (A)  
22. *Galium hoffmeisteri* (as subsp. of *G. asperuloides*: A)  
14. *Galium echinocarpum* (A)  
53. *Galium takasagomontanum* (M)  
59. *Galium triflorum* (A)  
58. *Galium trifloriforme* (Z)

*Galium* sect. *Trachygaliaceae* K. Schumann s.l.

48. *Galium sichuanense* (Z)  
13. *Galium dahuricum* (as “*G. davuricum*”: F; incl. *G. comarii*, *G. nietherthii*, *G. pseudoasprellum*)  
56. *Galium tokyoense* (as var. of “*G. davuricum*”: F)

41. *Galium prattii* (M)  
52. *Galium taiwanense* (M)  
3. *Galium asperifolium* (I)  
6. *Galium blinii* (as syn. of *G. asperifolium* var.: I; incl. *G. quinatum*: M)  
51. *Galium sungpanense* (A)  
42. *Galium pusillosetosum* (A)  
1. *Galium acutum* (M)  
43. *Galium rebae* (Z)  
33. *Galium megacyttarion* (Z)  
5. *Galium baldensiforme* (A)  
49. *Galium glabrusculum* (A)  
28. *Galium karataviense* (as *G. rivale* s.l.: K)  
61. *Galium uliginosum* (F)

*Galium* sect. *Leiogalium* Ledebour

38. *Galium paniculatum* (M; incl. *G. xinjiangense*: J)

*Galium* sect. *Orientigaliaceae* Ehrendorfer

8. *Galium bullatum* (I)

*Galium* sect. *Galium*

23. *Galium humifusum* (L)  
62. *Galium verum* (H)  
11. *Galium consanguineum* (as *G. majmechense*: H)  
46. *Galium saurense* (M)

*Galium* sect. *Aparine* W. D. J. Koch s.s.

50. *Galium spurium* (as *G. aparine* var. *tenerum*: B)  
2. *Galium aparine* (B)

*Galium* sect. *Kolgyda* Dumortier s.s.

57. *Galium tricorntum* (as *G. tricorne*: B)

*Galium* sect. *Microgalium* Grisebach

19. *Galium ghilanicum* (Z)  
55. *Galium tenuissimum* (C)

**Key to species of *Galium* and to related genera of the Rubiaceae**

- 1a. Interpetiolar stipules inconspicuous, multifid or fimbriate, not leaflike and not forming whorls with true leaves; corolla funnellform, (4 or)5-lobed; ovary and dry mericarps with hooked trichomes ..... *Kelloggia* (see p. 183)
- 1b. Interpetiolar stipules mostly leaflike and in whorls with true leaves, rarely reduced.
- 2a. Corolla lobes regularly 5; fruit fleshy, mericarps berrylike, 2(or 1, by non-development), often dispersed together ..... *Rubia* (see p. 305)
- 2b. Corolla lobes usually 4 (rarely 3); fruit dry or leathery, mericarps mostly 2, nearly always separating for dispersal.
- 3a. Leaves in middle stem region opposite, with stipules reduced or  $\pm$  leaflike and in whorls of 4 but then always clearly smaller than true leaves.
- 4a. Corolla pink, funnellform, with well-developed tube longer than lobes; fruit smooth ..... *Asperula oppositifolia* (see p. 78)
- 4b. Corolla white, rotate, with tube shorter than lobes; fruit with uncinat trichomes.
- 5a. Perennial herbs; leaves 5–30  $\times$  5–23 mm, obtuse to truncate at base, on petioles  
1.5–10 mm; flowers 3–11 in cymes; corolla with 4 lobes ..... 39. *G. paradoxum*
- 5b. Annual herbs; leaves 2–12  $\times$  1–4 mm, acute to cuneate at base, subsessile or on short petioles; flowers solitary at each node; corolla mostly with 3 lobes ..... 16. *G. exile*
- 3b. Leaves in middle stem region opposite and with very similar leaflike stipules in whorls of 4–16.
- 6a. Leaf apex rounded, obtuse, or  $\pm$  blunt, never acute or with a hyaline mucro; leaves in whorls of 4–6, linear to broadly oblong, 1-nerved, dried blackening; ripe mericarps globose, didymous and only with a short zone of contact, glabrous; corolla cup-shaped to slightly campanulate, 3- or 4-merous.
- 7a. Inflorescences with many-flowered cymes; corolla 4-lobed, 2.5–4 mm in diam.; leaves mostly 15–20  $\times$  5–8 mm ..... 27. *G. karakulense*
- 7b. Inflorescences with 1–3(or 4)-flowered cymes; corolla mostly 3-lobed, 1–1.8 mm in diam.; leaves mostly 3–8  $\times$  1–2 mm ..... 25. *G. innocuum*
- 6b. Leaf apex mostly  $\pm$  acute, often with a hyaline mucro; leaves in whorls of 4–16, sometimes broader and with 3–5 palmate nerves; ripe mericarps ovoid to subglobose, with a longer zone of contact and with diverse surface structures; corolla diverse, but often rotate and always 4-merous.
- 8a. Leaves and leaflike stipules in middle stem region never in whorls of more than 4 (if rarely in whorls of up to 6 then leaves with 3–5 palmate principal veins), from linear to broadly ovate.
- 9a. Stem apex vegetative, with few- to several-flowered lateral cymes only in leaf axils and shorter than or  $\pm$  equal to subtending leaves, nodding in fruit ..... *Cruciata* (see comments above)
- 9b. Stem apex usually floriferous, with terminal and axillary cymes, often longer than subtending leaves and mostly not nodding in fruit.
- 10a. Condensed plants of rocks or high elevations; stems usually less than 10 cm tall, glabrous or with spreading (but never retrorse) hairs; leaves mostly  $\pm$  ovate, (1–)3–8(–20)  $\times$  (0.8–)2–4(–10) mm, with 1–3 main veins; corolla rotate, often only 1.5–2 mm in diam.; mericarps with spreading (rarely appressed) hooked or  $\pm$  straight trichomes.
- 11a. Mericarps with  $\pm$  straight hairs, 2–2.5 mm in diam.; stems mostly pilose or hirtellous.
- 12a. Fruiting pedicels straight; Xizang ..... 47. *G. serpylloides*
- 12b. Fruiting pedicels nodding; Taiwan ..... 36. *G. nankotaizanum*
- 11b. Mericarps with weakly to strongly curved and uncinat trichomes; stems partly glabrous.
- 13a. Corolla ca. 3 mm in diam.; stems glabrous ..... 53. *G. takasagomontanum*
- 13b. Corolla 1.2–2 mm in diam.; stems  $\pm$  hairy or glabrous.
- 14a. Stems  $\pm$  hairy.
- 15a. Leaves ovate to broadly lanceolate, acute, up to 3.5 mm wide; Yunnan ..... 44. *G. rupifragum*
- 15b. Leaves broadly elliptic to obovate, obtuse and mucronate, up to 10 mm wide; Taiwan ..... 17. *G. formosense*
- 14b. Stems glabrous; Taiwan.
- 16a. Leaves very small, only 0.8–1 mm wide, with 1 main vein only; fruit hairs spreading ..... 34. *G. minutissimum*
- 16b. Leaves wider, with 1 or 3 main veins; fruit hairs appressed.
- 17a. Leaves with 3 main veins; corolla only ca. 1.2 mm in diam. .... 35. *G. morii*
- 17b. Leaves with 1 main vein; corolla ca. 2 mm in diam. .... 54. *G. tarokoense*
- 10b. Taller plants, usually of lower elevations with larger leaves (if plants  $\pm$  condensed then stem hairs retrorsely curved or fruit hairs appressed but not hooked).

- 18a. Leaves with 1 principal vein or 2 lateral veins only weakly visible and not extending past middle of blade.
- 19a. Open corollas funnelform, 2.5–3 mm, tube somewhat shorter than lobes; fruit with pericarp smooth to granular, becoming slightly inflated, enclosing both mericarps at dispersal ..... *Microphysa elongata* (see p. 216)
- 19b. Open corollas rotate, fused basal part much shorter than lobes; mericarps clearly separated.
- 20a. Stems ± strigose-hirsute, with hairs ± retrorse (but not retrorsely aculeolate); leaves ovate or elliptic to linear-lanceolate, broadest ± in middle, at lower side usually with glandlike spots; flowers unisexual, usually yellowish, ± greenish, or reddish; fruit normally with uncinat trichomes.
- 21a. Plants usually less than 15 cm tall, strongly branched from base; leaves often less than 8 mm, mostly glabrescent or glabrous, subleathery; inflorescences with few-flowered, bracteate cymes ..... 20. *G. glandulosum*
- 21b. Plants usually more than 15 cm tall, little branched; leaves usually longer than 8 mm, hairy on both sides; inflorescences paniculate to corymbiform, little bracteate.
- 22a. Leaves linear-elliptic to narrowly lanceolate, mostly 8–17 × 1–2.5 mm, dried rather papery; inflorescence paniculate ..... 21. *G. hirtiflorum*
- 22b. Leaves ovate-elliptic, mostly 8–12 × 3–5 mm, dried rather subleathery; inflorescence corymbiform ..... 18. *G. Forrestii*
- 20b. Stems glabrous or with indumentum, but not with retrorse hairs; leaves often broadest above middle and thinner, without glandlike spots; flowers usually bisexual.
- 23a. Leaves ± linear, often longer than 20 mm, in addition to 1 principal, with 2 weaker lateral veins; corolla 4–5 mm in diam.
- 24a. Leaves linear-spatulate, 1–4 mm wide; inflorescences loose, broadly paniculiform; ovaries and fruit glabrous and smooth ..... 31. *G. linearifolium*
- 24b. Leaves linear-lanceolate, 3–9 mm wide; inflorescences dense, elongate-paniculate; ovaries and fruit with sparse hooked trichomes or glabrous ..... 60. *G. turkestanicum*
- 23b. Leaves not linear, mostly shorter than 20 mm; corolla smaller.
- 25a. Leaves ovate, length/breadth index 2 or less, in addition to 1 principal, with 2 weaker lateral veins; corolla larger; fruit with spreading hooked or straight hairs; Taiwan.
- 26a. Mericarps with straight trichomes; corolla 2–2.5 mm in diam.; stems pilose or glabrescent ..... 36. *G. nankotaizanum*
- 26b. Mericarps with hooked trichomes; corolla ca. 3 mm in diam.; stems glabrous ..... 53. *G. takasagomontanum*
- 25b. Leaves ovate-oblong to lanceolate, length/breadth index 2 or more, with only 1 principal vein; corolla 1.5–2 mm in diam.; ovaries and fruit glabrous or with various indumentum.
- 27a. Leaves dried subleathery; fruit with appressed, ± curved (but not uncinat) hairs; Shanxi ..... 12. *G. crassifolium*
- 27b. Leaves dried papery; fruit with various indumentum.
- 28a. Plants ascending, weak, sparsely hairy or glabrous; inflorescence few flowered, peduncles and pedicels very thin and elongated, latter mostly 4–8 mm; fruit with spreading uncinat trichomes ..... 45. *G. salwinense*
- 28b. Plant erect, more robust, indumentum diverse; inflorescences ± many flowered, peduncles and pedicels thicker and shorter, latter mostly 2–4 mm; fruit tuberculate, with appressed or spreading hooked trichomes, or more rarely smooth ..... 9. *G. bungei*
- 18b. Leaves with 3–5 palmate principal veins, lateral veins well marked and extending for more than half of blade length.
- 29a. Corolla funnelform or cup-shaped, 2–5 mm in diam., with fused lower part ± as long as lobes; ovaries and fruit glabrous.
- 30a. Corolla cup-shaped or campanulate, 2–2.7 mm in diam.; cauline leaves broadly lanceolate, always in whorls of 4 ..... 30. *G. kunmingense*
- 30b. Corolla funnelform or campanulate, 2.5–5 mm in diam.; middle stem leaves ovate to elliptic, in whorls of 4–6.
- 31a. Open corollas 3.5–5 mm in diam.; cauline leaves usually in whorls of 4, 12–28 mm ..... 40. *G. platygalium*

- 31b. Open corollas 2.5–3.5 mm in diam.; cauline leaves in whorls of 4–6(–8),  
23–53 mm ..... 32. *G. maximoviczii*
- 29b. Corolla rotate, (1–)2–5 mm in diam., with fused base much shorter than lobes.
- 32a. Leaves linear to linear-lanceolate, 27–40 × 3–9 mm, in addition to 1 principal, with  
2 weaker lateral veins; corolla 4–5 mm in diam.; ovaries and fruit with sparse  
uncinate trichomes or glabrous ..... 60. *G. turkestanicum*
- 32b. Leaves lanceolate to ovate, shorter, 3 principal veins mostly readily visible.
- 33a. Fruit glabrous, smooth to granular-papillose, or with appressed and ± hooked or with  
spreading and straight (but never with spreading and hooked) trichomes.
- 34a. Open corollas 3–4 mm in diam.; stems (except nodes) mostly glabrous and smooth.
- 35a. Leaves ovate-lanceolate to ovate, papillose, length/breadth index mostly 2.5 or  
less; cymes rather few flowered; ovaries and fruit with ± appressed, apically  
somewhat bent trichomes ..... 10. *G. chekiangense*
- 35b. Leaves mostly rather narrowly lanceolate, smooth or ± hairy, length/breadth  
index mostly 3 or more; cymes many flowered; ovaries and fruit glabrous or  
with various indumentum ..... 7. *G. boreale*
- 34b. Open corollas (1–)2–2.5 mm in diam.; stems glabrous or ± hairy.
- 36a. Cauline leaves broadly to narrowly lanceolate, length/breadth index often  
3.5 or more.
- 37a. Stems hairy throughout; leaves lanceolate; fruit with straight hairs or rarely  
glabrous ..... 24. *G. hupehense*
- 37b. Stems (except nodes) glabrous; leaves ovate-lanceolate (sometimes also broader),  
apex subacute to acuminate, striate-punctate glandular below; fruit glabrous  
and smooth ..... 29. *G. kinuta*
- 36b. Cauline leaves narrowly to broadly ovate-lanceolate, length/breadth index usually  
3 or less.
- 38a. Leaves 6–30 × 3–20 mm; fruiting pedicels straight; fruit glabrous or scaberulous;  
mainland ..... 15. *G. elegans*
- 38b. Leaves 4–10 × 2–5 mm; fruiting pedicels nodding; fruit with ± straight  
trichomes; Taiwan ..... 36. *G. nankotaizanum*
- 33b. Fruit with ± spreading and uncinat trichomes.
- 39a. Open corollas 3 mm or more in diam.; stems (except nodes) often glabrous and smooth.
- 40a. Leaves lanceolate to ovate-lanceolate or elliptic, length/breadth index 3.5 or more,  
apex acute to acuminate ..... 7. *G. boreale*
- 40b. Leaves ovate, length/breadth index less than 3.
- 41a. Leaf apex obtuse to rounded, usually mucronate; mainland ..... 26. *G. kamschaticum*
- 41b. Leaf apex acuminate; Taiwan ..... 53. *G. takasagomontanum*
- 39b. Open corollas 2.5 mm or less in diam.; stems often ± hairy.
- 42a. Leaves ovate-lanceolate to narrowly elliptic, with acute apex, length/breadth  
index normally more than 2.5 ..... 63. *G. yunnanense*
- 42b. Leaves ovate to broadly elliptic, with obtuse to rounded apex, entire or shortly  
mucronate, length/breadth index normally less than 2.5.
- 43a. Leaves up to 20 mm wide; plants slender to usually rather robust; mainland ..... 15. *G. elegans*
- 43b. Leaves up to 10 mm wide; slender low plants; Taiwan ..... 17. *G. formosense*
- 8b. Leaves and leaflike stipules in middle stem region regularly in whorls of more than 4, i.e., in  
whorls of 5–16, with only 1 principal vein, linear to broadly lanceolate or elliptic, but never  
ovate or with a length/breadth index of less than 2.5.
- 44a. Inflorescences capitate and enclosed by leaflike bracts; corolla funnelform or salverform,  
4–15 mm, with 4 or 5 lobes.
- 45a. Plants perennial, 20–70 cm tall; calyx limb obsolete; corolla 5-lobed, 12–14 mm ..... *Phuopsis stylosa* (see p. 291)
- 45b. Plants annual; corolla 4-lobed, shorter.
- 46a. Calyx teeth well developed; corolla pink, tube 4–5 mm ..... *Sherardia arvensis* (see comments above)
- 46b. Calyx lacking; corolla bluish, tube 7–13(–15) mm ..... *Asperula orientalis* (see p. 78)
- 44b. Inflorescences branched, not enclosed by bracts; corolla rotate, campanulate,  
or funnelform, 0.5–13 mm, mostly with 4 (rarely 3) lobes.
- 47a. Medium stem leaves marginally (and often on upper side) with microhairs directed forward  
(use 20× lens), thus antrorsely ciliolate or aculeolate; stems mostly not retrorsely aculeolate.
- 48a. Ovaries and fruit densely covered with uncinat trichomes; plants perennial with smooth stems.

- 49a. Corolla funnelform, with tube  $\pm$  as long as lobes ..... 37. *G. odoratum*
- 49b. Corolla rotate, with tube markedly shorter than lobes.
- 50a. Robust, procumbent to ascending plants often longer than 50 cm; inflorescences terminal and lateral with cymes in upper 2–4 nodes ..... 59. *G. triflorum*
- 50b. Slender erect plants, less than 50 cm tall; inflorescences predominantly terminal.
- 51a. Leaves 6–25  $\times$  2–7 mm; open corollas ca. 2 mm in diam.; Taiwan (cf. also *G. takasagomontanum*) ..... 14. *G. echinocarpum*
- 51b. Leaves often larger; open corollas 1.5–3.5 mm in diam.; mainland.
- 52a. Leaves mostly in whorls of 7 or 8, (ob)lanceolate, length/breadth index mostly 3.5–4.5, subpetiolate; fruit with uncinata trichomes 0.6–0.8 mm; expected in Xizang ..... 4. *G. asperuloides*
- 52b. Leaves mostly in whorls of 6, narrowly obovate to broadly oblanceolate, length/breadth index mostly 2.5–3.5, clearly petiolate; fruit with uncinata trichomes 0.8–1.2 mm or longer; widespread ..... 22. *G. hoffmeisteri*
- 48b. Ovaries and fruit glabrous or hairy, but never with uncinata trichomes; plants perennial or annual.
- 53a. Plants annual, slender; flowers on pedicels and peduncles often longer than 5 mm and in lax, diffuse inflorescences.
- 54a. Leaves filiform, 20–30 mm, ascending; corolla funnelform, pink to red; ovary and mericarps with dense, short and curved hairs ..... *Leptunis trichodes* (see p. 213)
- 54b. Leaves linear to oblanceolate, 4–20 mm, spreading to reflexed; corolla  $\pm$  rotate, whitish, yellowish, or greenish; ovary and fruit glabrous or slightly tuberculate.
- 55a. Inflorescences broadly ovate, diffuse and intricate, with fruiting pedicels elongated to 20 mm ..... 55. *G. tenuissimum*
- 55b. Inflorescences rather narrowly thyrsoid, not diffuse and intricate, with fruiting pedicels only up to 4 mm ..... 19. *G. ghilanicum*
- 53b. Plants perennial, slender to robust; flowers on pedicels and peduncles 0.5–5 mm, in lax to  $\pm$  congested inflorescences.
- 56a. Corolla funnelform, lobed for 1/2–2/3, white.
- 57a. Inflorescences lax,  $\pm$  ebracteate; stems erect, smooth; main stem leaves 15–65  $\times$  3–12 mm ..... 38. *G. paniculatum*
- 57b. Inflorescences congested, strongly bracteate; stems procumbent, mostly  $\pm$  hairy; main stem leaves 5–23  $\times$  1–2(–5) mm ..... 23. *G. humifusum*
- 56b. Corolla rotate, lobed for 3/4 or more, often yellowish; plants erect to ascending.
- 58a. Leaves in middle stem region in whorls of not more than 6; plants of (sub)alpine region, not taller than 30 cm ..... 46. *G. saurense*
- 58b. Leaves in middle stem region in whorls of more than 6 and up to 12.
- 59a. Open corollas 3.5–5 mm in diam., white; fruit somewhat spongy or fleshy, 3–3.5 mm, with a dry pericarp separating from rest of fruit ..... 8. *G. bullatum*
- 59b. Open corollas ca. 3 mm in diam., yellow to whitish; fruit with dry mericarps, 1.5–2 mm, with pericarp dark and firmly attached to rest of fruit.
- 60a. Leaves mostly 2.5–5 mm wide, glabrous abaxially; fruit ca. 1.5 mm ..... 11. *G. consanguineum*
- 60b. Leaves 1–2.5 mm wide, glabrous to densely pubescent abaxially; fruit 1.5–2 mm ..... 62. *G. verum*
- 47b. Medium stem leaves marginally (not on leaf surface) with microhairs directed backward (use 20 $\times$  lens), thus retrorsely aculeolate or completely glabrous and smooth; stems often retrorsely aculeolate.
- 61a. Annuals, often in  $\pm$  disturbed, weedy habitats; stems and leaf margins retrorsely aculeolate; fully developed mericarps subspherical, 2–6 mm; open corollas 1–2 mm in diam.
- 62a. Fruit becoming pendulous on arching peduncles and pedicels, verrucose to spinulose; leaves glabrescent above ..... 57. *G. tricornutum*
- 62b. Fruit on divaricate straight peduncles and pedicels (only latter sometimes bent just beneath fruit), mostly with uncinata trichomes; leaves  $\pm$  hairy above.
- 63a. Open corollas 1.5–2 mm in diam.; individual mature mericarps 2.5–5 mm in diam., with trichomes arising from tuberculate bases ..... 2. *G. aparine*
- 63b. Open corollas 1–1.5 mm in diam.; individual mature mericarps 1–3 mm in diam., with trichomes straight from base ..... 50. *G. spurium*
- 61b. Perennials, in  $\pm$  natural habitats; fully developed mericarps ellipsoid, 1.5–3 mm; open corollas 1–4 mm in diam.

- 64a. Middle stem leaves narrowly obovate to oblanceolate, mostly 18–28 × 5–10 mm; stems slightly retrorsely aculeolate; inflorescences of medium size, with terminal and lateral, few- to several-flowered, rather loose cymes with small bracts, in fruit stiffly divaricate; corolla rotate, 1.5–2 mm in diam.; fruit with hooked trichomes ..... 58. *G. trifloriforme*
- 64b. Middle stem leaves mostly smaller; inflorescences different, usually more bracteate; fruit smooth, verrucose, or with hooked trichomes.
- 65a. Corolla funnelliform to subcampanulate, with tube ± as long as or slightly shorter than lobes, whitish; ovaries and fruit glabrous, smooth or verrucose; leaves papery to subleathery and glossy; stems rough, retrorsely aculeolate, procumbent to clambering.
- 66a. Corolla funnelliform; plants robust, 0.6–1.2 m, often forming mats; main stem leaves 8–50 × 2–8 mm ..... 28. *G. karataviense*
- 66b. Corolla subcampanulate; plants slender and ± erect, 10–60 cm tall; main stem leaves 3–16 × 1–3 mm ..... 61. *G. uliginosum*
- 65b. Corolla rotate, fused basal part much shorter than lobes; ovaries and fruit with hooked trichomes, tuberculate, or glabrous; stems glabrous, rough, or hairy.
- 67a. Middle stem leaves larger, (5–)10–35(–50) × (1–)2.5–10 mm, mostly ± hairy, at least margins retrorsely aculeolate; cymes lateral and terminal, many flowered; ovaries and fruit glabrous or with diverse indumentum; plants from lower elevations, relatively robust, erect or clambering, stems up to 0.7 m tall.
- 68a. Stems branched from base; cymes leafy, with bracts to last branches; stems and leaves (nodes and margins excepted) glabrous and smooth; mericarps with spreading uncinata trichomes ..... 48. *G. sichuanense*
- 68b. Stems normally branched from middle; cymes usually less leafy; stems and leaves mostly with more indumentum; fruit glabrous, papillose, tuberculate, or with uncinata trichomes.
- 69a. Peduncles and pedicels slender, filiform and often ± flexuose, with inconspicuous bracts; pedicels up to 5 mm, in fruit elongated to 10 mm or more; flowers never reddish; plants usually clambering; ovary and fruit surfaces diverse.
- 70a. Fruit often with uncinata trichomes; mainland ..... 13. *G. dahuricum*
- 70b. Fruit glabrous; Taiwan ..... 52. *G. taiwanense*
- 69b. Peduncles and pedicels rather stiff and often divaricate and ± bracteate; pedicels shorter than 5 mm and hardly elongated in fruit; ovary and fruit surfaces diverse, but often glabrous.
- 71a. Corolla red to purple (very rarely maroon or white), 1.5–2.5 mm in diam. .... 6. *G. blinii*
- 71b. Corolla whitish, yellowish, or greenish.
- 72a. Corolla small, 1.5–2 mm in diam., yellow to greenish white, lobes aristate; inflorescences divaricate and regularly bracteate with bracts similar to but smaller than leaves, giving a diffuse miniature aspect; ovary and fruit surface variable; plants often clambering ..... 3. *G. asperifolium*
- 72b. Corolla larger, mostly more than 2 mm in diam.; inflorescences ebracteate or with bracts ± reduced and irregularly distributed; ovary and fruit surface smooth to tuberculate; plants erect, hardly clambering.
- 73a. Leaves lanceolate, gradually narrowed into acute apex ..... 41. *G. prattii*
- 73b. Leaves subspatulate to obovate, apex rounded and abruptly narrowed into a mucro ..... 56. *G. tokyoense*
- 67b. Middle stem leaves uniformly small, 2–12(–15) × 0.3–3.5 mm, glabrous and smooth to ± hairy; cymes lateral and terminal, few flowered; ovaries and fruit with uncinata (very rarely ± straight) trichomes or glabrous; plants from high elevations, usually reduced and weak, caespitose to procumbent, stems only up to 0.3 m.
- 74a. Ovaries and fruit with uncinata (very rarely ± straight) trichomes.
- 75a. Leaves and stems ± densely hispid and often retrorsely aculeolate; stems with 4 conspicuous whitish angles ..... 42. *G. pusillosetosum*
- 75b. Leaves completely glabrous and smooth or only slightly hairy and/or retrorsely aculeolate; stems with 4 inconspicuous angles.
- 76a. Leaves dried blackening, papery and thin, oblanceolate to narrowly obovate, with flat margins, hardly longer than 7 mm ..... 5. *G. baldensiforme*
- 76b. Leaves dried greenish-brownish, with ± revolute margins, often longer than 7 mm.
- 77a. Plants nearly always smooth; leaves ± subleathery; ovary in flower ca. 1 mm ..... 49. *G. glabriusculum*

- 77b. Plants retrorsely aculeolate at least on margins and lower side of papery leaves; ovary in flower 0.5–0.8 mm ..... 51. *G. sungpanense*
- 74b. Ovaries and fruit glabrous, smooth, papillose, or verrucose; Himalaya.
- 78a. Plants weak to procumbent but not mat-forming; cells of adaxial leaf surface relatively large, readily visible individually with 20× lens; corolla mostly whitish ..... 33. *G. megacyttarion*
- 78b. Plants procumbent and often mat-forming; cells of adaxial leaf surface small, not or hardly visible individually with 20× lens.
- 79a. Stems ± densely hairy and/or retrorsely aculeolate, with 4 conspicuous whitish angles ..... 42. *G. pusillosetosum*
- 79b. Stems glabrous or only slightly retrorsely aculeolate, with inconspicuous angles.
- 80a. Leaves on main stems 2–8.5 mm; inflorescence cymes 1- to few flowered, fascicled; corolla white, pale green, or pale yellow, with upper surface of lobes papillose ..... 1. *G. acutum*
- 80b. Leaves on main stems 5–10.5 mm; inflorescence cymes 1–6-flowered; corolla nearly always red or purple, with upper surface of lobes glabrous and smooth except ± puberulent on margins and central vein ..... 43. *G. rebae*

**1. *Galium acutum*** Edgeworth, Trans. Linn. Soc. London 20: 61. 1846.

尖瓣拉拉藤 jian ban la la teng

Herbs, perennial, procumbent, much branched, mat-forming. Stems up to 30 cm, 4(or 6)-angled, glabrous, smooth or sometimes with scattered (very rarely more dense) short and straight hairs. Leaves in whorls of up to 6, sessile; blade drying papery and blackish, linear-oblongate to narrowly elliptic-oblongate, 2–8.5 × 0.3–1.5 mm, glabrous and smooth, occasionally with straight hairs, base cuneate, margins flat to thinly revolute, very rarely antorsely aculeolate, apex acute, ± contracted and mucronate; vein 1. Inflorescences with terminal and axillary cymes, 1- to few flowered; peduncles (1.5–)3–8(–10) mm; pedicels (0.1–)0.5–2(–3) mm, glabrous, smooth. Ovary ellipsoid-obovoid, ca. 0.5 mm, didymous, glabrous. Corolla white, pale greenish, or yellowish, rotate, 1.2–3.5 mm in diam., glabrous to puberulent, lobed for 2/3 or more; lobes 4, lanceolate-spatulate, inside (i.e., adaxially) papillose, shortly acuminate. Mericarps ellipsoid, ca. 1 × 0.4–0.6 mm, glabrous, smooth or granular-verruculose, often on elongating pedicels. Fl. and fr. Jul–Oct.

Mountain rocks and slopes; 2000–4100 m. ?Sichuan, Xizang, ?Yunnan [India, Nepal, Pakistan].

*Galium acutum* is a (sub)alpine Himalayan member of the *G. asperifolium* group (see under that species). This group of taxa can be divided into subgroups: (1) from lower elevations and (2) from higher elevations. The latter subgroup is represented in the W Himalaya of Pakistan by *G. acutum* alone (Nazimuddin & Ehrendorfer, Pl. Syst. Evol. 155: 71–75. 1987). Mill (Edinburgh J. Bot. 53: 193–213. 1996; Fl. Bhutan 2(2): 825–834. 1999) has analyzed both subgroups in detail with emphasis on their E Himalayan members. Among subgroup (2) he recognized three species: *G. acutum* and the newly described *G. rebae* and *G. megacyttarion*. The only material from China incorporated in Mill's study are specimens of *G. rebae* from Xizang deposited at E and BM. Additional species from subgroup (2) from the C and E Himalaya and adjacent China treated here are *G. baldensiforme*, *G. pusillosetosum*, *G. glabriusculum*, and *G. sungpanense*. They appear well separable from *G. acutum*.

*Galium acutum* and *G. rebae* are very closely related taxa. Mill (loc. cit. 1996: 199) presented a differential table which has been incor-

porated into the present descriptions. Nevertheless, from the material available now, it appears that only flower color (white or greenish white in *G. acutum* and reddish crimson in *G. rebae*) is really decisive for their separation. Furthermore, at lower elevations, *G. acutum* appears linked to *G. asperifolium* var. *sikkimense*. Cufodontis (Oesterr. Bot. Z. 89: 239. 1940) has described such transitional forms with longer and ± retrorsely aculeolate stems and hairy corolla lobes from the Indian Himalaya as *G. acutum* var. *trichanthum* Cufodontis.

Mill (loc. cit. 1996: 194–198) considered *Galium acutum* to be restricted to the NW Himalaya except for one provisionally identified specimen from Sikkim. In contrast, specimens studied by us from the herbaria PE, KUN, and WU clearly show that *G. acutum* extends much further to the east, reaching Yunnan and Sichuan.

*Galium himalayense* was regarded as a synonym of *G. acutum* by Cufodontis (loc. cit.: 239–243). Mill (loc. cit. 1996: 195; loc. cit. 1999: 831–832) agreed but maintained the taxon as *G. acutum* var. *himalayense* and described its sympatric occurrence with *G. acutum* var. *acutum* throughout the NW Himalaya. As Mill did not consider the possible occurrence of flower dimorphism in *G. acutum*, it remains uncertain whether the flower and stigma size differences listed are possibly correlated with male and female plants or simply correspond to hermaphroditic variants within the morphological amplitude of the species. In order to stimulate such studies and to clarify the distribution of the two taxa in China, a key and descriptions (according to Mill, loc. cit. 1996) follow:

- 1a. Open corollas 2.3–3.5 mm in diam.; stigmas united to near middle, in total length subequal to stamens ..... 1a. var. *acutum*
- 1b. Open corollas 1.2–2.3 mm in diam.; stigmas united only shortly at base, in total length shorter than stamens ..... 1b. var. *himalayense*

**1a. *Galium acutum* var. *acutum***

尖瓣拉拉藤(原变种) jian ban la la teng (yuan bian zhong)

*Galium asperifolium* Wallich var. *setosum* Cufodontis.

Leaves of main stems with blades mucronate at apex, mucro 0.2–0.45 mm. Corolla 2.3–3.5 mm in diam.; lobes 1.9–4 × as long as wide, mucronate with mucro 0.15–0.3 mm. Stigmas united to near middle, in total length subequal to stamens. Fl. and fr. Jul–Oct.

Mountain rocks and slopes; 2000–4100 m. ?Sichuan, Xizang, ?Yunnan [India, Nepal, Pakistan].

**1b. *Galium acutum* var. *himalayense*** (Klotzsch & Garcke) R. R. Mill, *Edinburgh J. Bot.* 53: 195. 1996.

喜马拉雅尖瓣拉拉藤 xi ma la ya jian ban la la teng

*Galium himalayense* Klotzsch & Garcke, *Bot. Ergebn. Reise Waldemar*, 88. 1862.

Leaves of main stems with blade submucronate at apex, mucro 0.15–0.2 mm. Corolla 1.2–2.3 mm in diam.; lobes 1.4–2.75 × as long as wide, acute or submucronate with mucro to 0.1 mm. Stigmas united only shortly at base, in total length shorter than stamens. Fl. and fr. Jul–Oct.

Mountain rocks and slopes; 2000–4100 m. ?Sichuan, Xizang, ?Yunnan [India, Nepal].

**2. *Galium aparine*** Linnaeus, *Sp. Pl.* 1: 108. 1753, s.s.

原拉拉藤 yuan la la teng

Herbs, annual, procumbent or clambering. Stems 30–90 cm high, 4-angled, 1–4 mm in diam., branched from base, retrorsely aculeate along angles, glabrescent to pilose at nodes. Leaves at middle stem region in whorls of 6–10, subsessile; blade drying papery, narrowly oblanceolate to narrowly oblong-oblanceolate, 10–60 × 3–10 mm, usually somewhat pilosulous or hispidulous adaxially, retrorsely aculeolate along midrib abaxially, base acute, margins flat to thinly revolute, retrorsely aculeolate, apex acute and shortly mucronate; vein 1. Inflorescences terminal and axillary, cymes 2- to several flowered; axes glabrous to aculeolate; bracts ± leaflike or none, 1–5 mm; peduncles 1–5 cm; pedicels 1–30 mm, finally elongating and sometimes curved directly under fruit. Ovary subglobose, 0.3–0.5 mm, with uncinatate trichomes. Flowers hermaphroditic. Corolla yellowish green or white, rotate, 1.5–2 mm in diam.; lobes 4, triangular to ovate, acute. Mericarps subglobose to kidney-shaped, 2.5–5 mm, with a dense cover of uncinatate trichomes 0.4–1.2 mm from swollen base. Fl. Mar–Jul, fr. Apr–Nov.

Forest margins, riversides, meadows, open fields, farmlands; near sea level to 2500 m. Evidently rare in China and possibly only introduced [originally in W Eurasia and the Mediterranean, but today nearly worldwide as an adventive].

The *Galium aparine* group (*G.* sect. *Aparine*, formally part of *G.* sect. *Kolgyda* s.l.) forms an annual, extremely polymorphic, and predominantly autogamous polyploid complex, also called *G. aparine* s.l. or *G. aparine* agg. One has to consider as possible perennial ancestors the morphologically very close E Asiatic taxa (e.g., *G. sungpanense*: see there) and other annuals, such as the Aegean endemic *G. monachinii* Boissier & Heldreich ( $2x$ ,  $2n = 22$ ) and the Eurasian and African *G. spurium* ( $2x$  and  $4x$ ,  $2n = 20, 40$ ). By allopolyploidy they apparently have contributed in the Mediterranean and W Eurasia to *G. aparine* s.s. ( $4x$ ,  $6x$ , and  $8x$  with ± euploid and slightly oscillating aneuploid chromosome numbers), which today has become a nearly worldwide weed (Ehrendorfer et al., *Fl. Iranica* 176: 239. 2005).

Many authorities, including Cufodontis (*Oesterr. Bot. Z.* 89: 245–247. 1940) and W. C. Chen (in *FRPS* 71(2): 234–237. 1999), have treated all these plants under *Galium aparine* s.l. and recognized four varieties: var. *aparine*, var. *echinospermum*, var. *leiospermum*, and var. *tenerum*. Whereas the first refers to *G. aparine* s.s. described above, the

latter three should be assigned to *G. spurium* (see there). Here, we follow the narrow circumscription of *G. aparine* s.s. and the specific separation of *G. spurium* outlined above, in spite of occasional difficulties in separating the two taxa on the basis of flower and mericarp size. A relevant survey of extensive Chinese material at the herbaria PE and KUN has clearly shown the common and wide occurrence of *G. spurium* in comparison with the rare and only occasional documentation of *G. aparine* s.s. Only future karyosystematic studies on the group in E Asia will clarify their distribution and ecological position. With respect to the common confusion of members of the *G. aparine* group with other annual and perennial taxa of *Galium* see *G. spurium*.

**3. *Galium asperifolium*** Wallich in Roxburgh, *Fl. Ind.* 1: 381. 1820.

楔叶律 xie ye lü

?*Galium cavaleriei* H. Léveillé; ?*G. esquirolii* H. Léveillé.

Herbs, perennial, weak to climbing or trailing, usually much branched. Stems 20–70 cm, 4-angled to 4-winged, villosulous to hirtellous and/or sparsely aculeolate to smooth. Leaves on main stems in whorls of up to 6(–8), sessile or with very short (ca. 1 mm) petiole; blade drying papery to leathery, adaxially dark green and shiny, abaxially paler, oblanceolate-oblong, oblanceolate, or obovate, (5–)10–20(–25) × (1–)1.5–4(–6) mm, adaxially scaberulous, hirtellous to glabrous, abaxially densely villosulous, hirsute, pilose to glabrous, base acute to cuneate, margins retrorsely aculeolate and ± hairy, flat to thinly revolute, apex obtuse, rounded, truncate, or emarginate and shortly mucronate; vein 1. Inflorescences ± paniculate, up to 18 cm, expanding through growing season, with terminal and axillary, several- to many-flowered cymes; peduncles glabrous to rarely villosulous, regularly spreading to divaricate, with a dichasial branching pattern, at most nodes with leaflike bracts (1–4 mm); pedicels 0.2–2.5 mm. Ovary obovoid, 0.2–0.3 mm, mostly glabrous or smooth, but sometimes also verrucose, hirtellous, or with undeveloped uncinatate trichomes. Corolla greenish white or yellow, rotate, 1.5–2 mm in diam., glabrous, lobed for 2/3 or more; lobes 4, triangular-ovate, filamentous-aristate (rarely only acute). Mericarps ellipsoid, 1–2 mm, glabrous and smooth or rarely granular-tuberculate, hirtellous, or with appressed to spreading hooked trichomes, on pedicels often slightly elongating to 4 mm. Fl. and fr. (May–)Jun–Sep(–Oct).

Mountain slopes, farmland sides, riversides and beaches, grasslands, forests, thickets, ditch sides, open fields, meadows; 400–3500 m. Guangxi, Guizhou, Hubei, Hunan, Sichuan, Xizang, Yunnan [Afghanistan, Bangladesh, Bhutan, India, Nepal, Pakistan, Sri Lanka, Thailand].

*Galium asperifolium* is an exceedingly variable and widespread species and was the first described from a larger assembly of taxa, here called *G. asperifolium* group and provisionally placed into *G.* sect. *Trachygalium* (but certainly not into *G.* sect. *Leptogalium* as in Yamazaki, *Fl. Japan* 3a: 238–239. 1993, or into *G.* sect. *Leiodalium* as in W. C. Chen, *FRPS* 71(2): 271. 1999). According to Cufodontis (*Oesterr. Bot. Z.* 211–251. 1940), Nazimuddin and Ehrendorfer (*Pl. Syst. Evol.* 155: 71–75. 1987), Mill (*Edinburgh J. Bot.* 53: 193–213. 1996; *Fl. Bhutan* 2(2): 825–834. 1999), Ehrendorfer et al. (*Fl. Iranica* 176: 194. 2005), and the present treatment, the center of diversity of the *G. asperifolium* group lies in the E Himalaya and SW China. Within this area, two subgroups of taxa can be recognized, one with larger plants, longer than 10 mm middle stem leaves, and many-flowered cymes from lower eleva-

tions (1), the other with more condensed growth, shorter middle stem leaves, and 1- to few-flowered cymes from higher elevations (2). Both subgroups include taxa with whitish, yellowish to greenish, and others with reddish, purplish, or brownish flower color. The (sub)alpine subgroup (2) is briefly surveyed under *G. acutum*. Subgroup (1), discussed here, is represented by taxa with ± whitish flowers: *G. subfalcatum* Nazimuddin & Ehrendorfer and *G. campylotrichum* Nazimuddin & Ehrendorfer in the W Himalaya of Pakistan and the widespread *G. asperifolium* with its var. *sikkimense* (= *G. sikkimense*) in the C and E Himalaya (including Bhutan). In addition, subgroup (1) includes taxa with a more easterly distribution, extending from China into the remaining parts of E Asia (including Japan): *G. dahuricum* (including *G. comarii*, *G. manshuricum*, *G. niewerthii*, and *G. pseudoasprellum*), *G. prattii*, *G. taiwanense*, and *G. tokyoense*. Subgroup (1) taxa with reddish flowers are *G. blinii* in SW China and the newly described Bhutan endemic *G. craticulatum* R. R. Mill (see also Mill, loc. cit. 1996; loc. cit. 1999).

Because of its great variability with respect to habit and the indumentum of stems, leaves, and fruit, *Galium asperifolium* is often not easily separable from its closest relatives, and transitional forms occur. Its best differential characters are the many-flowered, divaricate, distally dichasial branching, and strongly bracteate cymes and the small yellowish-greenish flowers with aristate corolla lobes. *Galium blinii* mainly deviates by larger, reddish flowers and non-aristate corolla lobes. The filiform and flexuose peduncles and pedicels separate *G. dahuricum*, and the less bracteate inflorescences and larger flowers separate *G. prattii*, *G. taiwanense*, and *G. tokyoense*. To the taxa of the (sub)alpine subgroup (2, e.g., *G. acutum*) *G. asperifolium* is linked particularly through its var. *sikkimense*.

In addition to its natural complexity, the taxonomy of the *Galium asperifolium* group is rendered difficult by a number of badly described and insufficiently documented species created by H. Léveillé. On the basis of the studies by Cufodontis (loc. cit.), Lauener and Ferguson (Notes Roy. Bot. Gard. Edinburgh 32: 103–115. 1973), Mill (loc. cit. 1996), and our own judgment, we suggest to dispose of them in the following way: *Galium blinii* is maintained as a separate species (possibly with *G. bodinieri* and *G. quinatum* as synonyms), whereas *G. cavaleriei* and *G. esquirolii* (and “*G. cuneatum* H. Léveillé,” though a nomen nudum) are provisionally assigned as synonyms to *G. asperifolium* s.l. (including var. *sikkimense*); *G. comarii* and *G. niewerthii* are treated as synonyms of *G. dahuricum*.

The following schematic key to the varieties of *Galium asperifolium* corresponds to W. C. Chen (loc. cit.: 271–274) who mainly followed Cufodontis (loc. cit.: 239–240). Only *G. asperifolium* var. *setosum* has been eliminated because it clearly is a synonym of *G. acutum*. Individuals with uncinete trichomes on ovaries and fruit, but otherwise identical to typical *G. asperifolium*, are reported here for the first time. They still lack a varietal name and are provisionally accommodated under var. *asperifolium*. In contrast to Mill (loc. cit. 1996; loc. cit. 1999), *G. sikkimense* is here again reduced to varietal status under *G. asperifolium*, following Cufodontis (loc. cit.: 241). Forms of this species with ± glabrescent stems dominate to the east of its wide distribution area, but intraspecific and local variation of stem indumentum is so extensive and continuous as to make this character useless as a basis for specific separation. Mill (loc. cit. 1996: 201–212) assumed *G. asperifolium* var. *asperifolium* to be most common in C and W Nepal and to be replaced by var. *sikkimense* toward the east. This statement is in conflict with the data on distribution in China from Chen (loc. cit.) and our own observations presented below. In view of the taxonomical complexity of the *G. asperifolium* group and the common misinterpretation of its members, further careful studies are obligatory.

- 1a. Plants stout, often clambering; stems usually villosulous to hirtellous and ± densely

retrorsely aculeolate; leaf blade relatively large, often oblanceolate-oblong, ± hairy and marginally retrorsely aculeolate; inflorescence large, many flowered; corolla lobes aristate.

- 2a. Ovary and fruit glabrous, smooth, granular-tuberculate, or with uncinete trichomes ..... 3a. var. *asperifolium*  
2b. Ovary and fruit hirtellous ..... 3b. var. *lasiocarpum*

- 1b. Plants often ± smaller; stems with ± reduced indumentum; leaf blade smaller, often more lanceolate, more weakly retrorsely aculeolate to smooth along margins; inflorescence with fewer flowers; corolla lobes apiculate to acute.  
3a. Mericarps smooth ..... 3c. var. *sikkimense*  
3b. Mericarps granular-tuberculate ..... 3d. var. *verrucifrutum*

### 3a. *Galium asperifolium* var. *asperifolium*

楔叶律(原变种) xie ye lü (yuan bian zhong)

*Galium pseudohirtiflorum* H. Li.

Plants stout, often clambering. Stems 20–70 cm, much branched, villosulous or hirtellous, ± retrorsely aculeolate. Leaf blade often larger, oblanceolate-oblong, mostly ± hirsute and with margins retrorsely aculeolate. Inflorescences large, with many-flowered cymes. Corolla lobes filamentous-aristate. Ovary and fruit glabrous and smooth, verrucose, or rarely with uncinete trichomes. Fl. and fr. Jun–Sep.

Mountain slopes; 1200–3000 m. Guizhou, Sichuan, Xizang, Yunnan [Afghanistan, Bangladesh, India, Nepal, Pakistan, Sri Lanka, Thailand].

**3b. *Galium asperifolium* var. *lasiocarpum* W. C. Chen, Acta Phytotax. Sin. 28: 303. 1990.**

毛果楔叶律 mao guo xie ye lü

Ovary and fruit hirtellous. Fl. and fr. May–Oct.

● Mountain slopes, farmland sides, riversides, forests; 1400–3200 m. Guangxi, Guizhou, Yunnan.

Mill (loc. cit. 1996) commented on the extensive indument variation on all organs of *Galium asperifolium* throughout most of its range but did not mention any occurrence of straight hairs on fruit in this species group, nor has anyone else besides W. C. Chen. Therefore, this variety is only provisionally included here. Its densely hirsute ovary and fruit suggests that it may belong to another species, possibly *G. pusillosetosum*.

**3c. *Galium asperifolium* var. *sikkimense* (Gandoger) Cufodontis, Oesterr. Bot. Z. 89: 241. 1940.**

小叶律 xiao ye lü

*Galium sikkimense* Gandoger, Bull. Soc. Bot. France 66: 307. 1920.

Herbs, perennial, weak to clambering or trailing. Stems 20–60 cm, usually much branched, sparsely hairy and retrorsely aculeolate to smooth. Leaves often smaller and narrower, less

hairy and retrorsely aculeate to  $\pm$  glabrous and smooth. Inflorescences large to medium sized with many- to several-flowered cymes. Corolla lobes apiculate to acute. Ovary and fruit glabrous and smooth. Fl. Jun–Sep, fr. Jul–Oct.

Mountain slopes, river beaches, ditch sides, open fields, grasslands, meadows, thickets, forests; 400–3200 m. Guangxi, Guizhou, Hubei, Hunan, Sichuan, Xizang, Yunnan [Bhutan, India, Nepal].

**3d. *Galium asperifolium* var. *verrucifrutum*** Cufodontis, Oesterr. Bot. Z. 89: 241. 1940.

滇小叶律 dian xiao ye lü

Similar to *Galium asperifolium* var. *sikkimense* but with granular-tuberculate fruit. Fl. and fr. Aug–Oct.

• Mountain slopes, grasslands, thickets; 2300–3500 m. Sichuan, Xizang, NW Yunnan.

The type material of this variety from Yunnan (particularly *Handel-Mazzetti 9697*, WU) consists of transitional forms toward *Galium acutum*.

**4. *Galium asperuloides*** Edgeworth, Trans. Linn. Soc. London 20: 61. 1846.

车叶律 che ye lü

Herbs, perennial, emerging from filiform reddish rhizomes. Stems weak but generally erect, 10–45 cm tall, 4-angled, glabrous and smooth, except hispidulous at nodes. Middle stem leaves and leaflike stipules in whorls of (6 or)7 or 8, sessile to very shortly petiolate; blade drying papery or membranous, remaining green, elliptic to narrowly oblong-ob lanceolate or lanceolate, (10–)20–50(–60)  $\times$  3–13 mm, length/breadth index mostly 3.5–4.5, glabrescent, base acute or cuneate, midrib smooth or rarely retrorsely aculeolate, margins and upper leaf side with antrorse microhairs, apex obtuse or rounded and abruptly apiculate; vein 1. Inflorescences terminal and sometimes in axils of upper leaves with few- to several-flowered cymes; axes glabrous, smooth; bracts none or few, 1–2 mm; pedicels 0.5–5 mm. Ovary ovoid, 0.5–0.8 mm, with uncinete trichomes. Corolla white or light greenish, rotate, 2.5–3.8 mm in diam., lobed for 3/4 or more; lobes 4, ovate, acute. Mericarps ellipsoid, 1.8–2.5 mm, with dense uncinete trichomes 0.6–0.8 mm, on fruiting pedicels elongating to 10 mm. Fl. Apr–Aug, fr. May–Sep.

Forests on mountain slopes, thickets, ditch sides, along rivers, meadows; 1500–2800 m. Expected in Xizang [Afghanistan, India, Kashmir, Pakistan].

*Galium asperuloides* was previously circumscribed more broadly to include as subspecies plants treated here as *G. hoffmeisteri*. The specific status of the latter is well justified (Ehrendorfer et al., Fl. Iranica 176: 193–194. 2005; see comments and differential characters under that species). When the two taxa are classified as one species, the “typical” plants have to be called *G. asperuloides* subsp. *asperuloides*. Vegetative plants are very similar to *G. odoratum*. Together with *G. echinocarpum* from Taiwan and others they constitute *G. sect. Hylaea*.

**5. *Galium baldensiforme*** Handel-Mazzetti, Symb. Sin. 7: 1029. 1936.

玉龙拉拉藤 yu long la la teng

Herbs, perennial, tender, caespitose. Stems ascending, 3–12(–25) cm tall, 4-angled, glabrous and smooth or rarely slightly retrorsely aculeolate. Leaves in whorls of up to 5 or 6, sessile; blade drying papery and blackish, oblanceolate to narrowly obovate, 2–7  $\times$  1–3 mm, mostly glabrous and smooth, but occasionally with straight hairs abaxially or marginally slightly retrorsely aculeolate, base cuneate, margin flat, apex acute and often shortly mucronate; vein 1. Inflorescences with cymes terminal and in axils of upper leaves, 1- or usually 2- or 3-flowered; peduncles up to 18 mm and pedicels 2–5 mm, glabrous and smooth, elongating during fruit development. Ovary subglobose, ca. 0.7 mm, densely covered by undeveloped trichomes. Corolla pale green, rotate, ca. 2 mm in diam., glabrous; lobes 4, triangular, acute. Mericarps ellipsoid, ca. 2 mm, with dense brownish yellow uncinete trichomes ca. 0.7 mm. Fl. Aug, fr. Aug–Oct.

• Rocky slopes, meadows, frost heave sites, river floodplains in mountains; 2800–4300 m. Qinghai, Sichuan, Xizang, Yunnan (Lijiang).

*Galium baldensiforme* belongs to the alpine subgroup (2) of the *G. asperifolium* complex within *G. sect. Trachygalium* s.l. (see under *G. acutum* and *G. asperifolium*). It has been widely misidentified with related taxa, e.g., with *G. glabriusculum* from which it differs in its more oblanceolate, thinner leaves, blackening when dried, and a slight tendency toward more indumentum.

Two collections from Xizang (*H. Li 1978-07-22* and *Y. T. Chang & Lang, Nie-La-Mu, 1966-06-25*, both from PE) differ from typical *Galium baldensiforme* by purple flowers (reminiscent of *G. rebae*),  $\pm$  straight whitish hairs on its (still young) ovaries, and scattered straight hairs on the upper and lower leaf sides (mainly midvein, but glabrous along leaf margins). After closer inspection and field studies, these populations may very well deserve species rank.

A specimen from Sichuan (Dege Co., anonymous collector 7029, PE) with stronger indumentum, subleathery, broadly lanceolate leaves with retrorsely aculeolate margins, and aristate corolla lobes apparently links *Galium baldensiforme* with *G. asperifolium* var. *sikkimense*.

**6. *Galium blinii*** H. Léveillé, Bull. Acad. Int. Géogr. Bot. 25: 48. 1915.

五叶拉拉藤 wu ye la la teng

?*Galium bodinieri* H. Léveillé; ?*G. quinatum* H. Léveillé & Vaniot.

Herbs, perennial, weak to climbing, trailing, or matted. Stems usually much branched, 20–70 cm, 4-angled, retrorsely aculeolate to glabrescent. Middle stem leaves in whorls of 6–8, subsessile; blade drying papery or leathery, often blackening, linear-oblong to broadly (ob)lanceolate, (5–)10–22(–30)  $\times$  (1–)2–4.5(–5.5) mm, adaxially and particularly abaxially  $\pm$  rough, base acute to cuneate, margin flat to thinly revolute, densely retrorsely aculeolate,  $\pm$  gradually narrowed into acute apex; vein 1. Inflorescences with terminal and axillary, several-flowered cymes 2–5 cm; axes  $\pm$  glabrous, often slightly divaricate, with small bracts on lower branches only; pedicels (0.2–)1–3(–5) mm. Ovary obovoid, 0.2–0.3 mm, glabrous or with undeveloped trichomes. Corolla red to purple or violet (only very rarely white), rotate, 1.5–2.5(–3) mm in diam., glabrous; lobes 4, triangular-ovate, acute. Mericarps ovoid, 1–2 mm, glabrous, smooth to verrucose, or sometimes with appressed or spreading uncinete trichomes. Fl. Jun–Sep, fr. Jul–Oct.

• Mountain slopes, river beaches, ditch sides, open fields, grasslands, meadows, thickets, forests; 800–3000 m. Guizhou, Hubei, Shaanxi, Sichuan, Xizang, Yunnan.

*Galium blinii* is a critical taxon that belongs to the lower elevation subgroup (1) of the *G. asperifolium* group (see there). It was considered a synonym of *G. asperifolium* var. *sikkimense* by Cufodontis (Oesterr. Bot. Z. 89: 241. 1940), Lauener and Ferguson (Notes Roy. Bot. Gard. Edinburgh 32: 106. 1973), and W. C. Chen (in FRPS 71(2): 273. 1999). Only Mill (Edinburgh J. Bot. 53: 204. 1996) commented on its reddish purple flowers and other differential characters, regarded it as a distinct species, and proposed to use its old but so far neglected name. Up to now, specimens of this rather widespread taxon were named as *G. asperifolium* var. *sikkimense*, *G. pseudoasprellum* var. *densiflorum*, etc. Analyses of a considerable number of relevant specimens from PE, KUN, and WU support Mill's interpretation and led to the above, more elaborate description. It shows that *G. blinii* is quite variable with respect to leaf shape and ovary/fruit indumentum but relatively well characterized not only by its reddish purple flowers but also by height, leaf size, retrorsely aculeolate stems and leaf margins, and the usually medium-sized and only small-bracteate cymes, relatively short and firm post-floral peduncles and pedicels, and larger flowers with acute (but not aristate) lobes. This allows separation from its closest relatives, *G. prattii* and *G. asperifolium* (where transitional forms occur), but also from *G. dahuricum* and *G. tokyoense*.

Further studies will have to show to what extent the following, also reddish purplish flowering taxa from SW China can be separated from *Galium blinii*: *G. craticulatum* was described as an endemic from the high mountains of Bhutan (Mill, loc. cit.: 202) and said to differ from *G. blinii* in its present circumscription by completely glabrous stems with conspicuous, vein-marked wings, less retrorsely aculeolate leaves, larger flowers, and longer filaments; *G. bodinieri*, also with reddish flowers, according to Mill (loc. cit.: 204–205) is reminiscent of *G. craticulatum* (particularly in its broadly winged stems) and may represent a link between *G. blinii* and the alpine, more condensed and shorter leaved *G. rebae*; the purple-flowered *G. quinatum* (not mentioned by Mill) was very poorly described and is listed above as a possible synonym of *G. blinii*, but types have neither been seen by Lauener and Ferguson (loc. cit.: 107) nor by us.

### 7. *Galium boreale* Linnaeus, Sp. Pl. 1: 108. 1753, s.l.

北方拉拉藤 bei fang la la teng

Herbs, perennial, erect, 20–65 cm tall. Stems 4-angled, usually glabrous, rarely shortly hairy, hispidulous at nodes, angles thickened. Leaves in whorls of 4, sessile or subsessile; blade drying papery or thinly leathery, linear-lanceolate or lanceolate to ovate, (10–)15–40(–80) × (1–)3–15 mm, glabrous or sparsely puberulent to hispidulous and/or pilose, abaxially never with striate to punctate glandular idioblasts, base cuneate to subrounded, margins usually revolute and antrorsely scaberulous to hispidulous, apex acute or usually narrowly tapered then obtuse to rounded at very tip; principal veins palmate, 3. Inflorescences terminal, elongate or broadly paniculiform, 2–15 cm, with several- to many-flowered cymes in axils of uppermost leaves and terminal; peduncles glabrous or puberulent at nodes, smooth or scaberulous; bracts ligulate, lanceolate, or elliptic, 1–4 mm; pedicels 0.5–2 mm elongating in fruit to 3.5 mm. Ovary subglobose, 0.8–1 mm, glabrous or sparsely to densely strigillose to pilosulous. Corolla white or pale yellow, rotate, 3–4 mm in diam., glabrescent, lobed for 3/4 or more; lobes 4, ovate-lanceolate, acute. Mericarps subglobose, 1–2 mm, pericarp firmly attached but sometimes ± inflated, glabrous or ± densely hairy

with ± appressed, ascending, or spreading, straight or curved, but hardly truly uncinuate trichomes 0.3–0.5 mm. Fl. May–Aug(–Sep), fr. (May–)Jun–Oct.

Open forests and thickets, mountain slopes, grasslands, meadows, open fields, ditch sides, river valleys and beaches, swamps, farmland sides, wastelands; 200–4600 m. Gansu, Hebei, Heilongjiang, Henan, Jilin, Liaoning, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shandong, Shanxi, Sichuan, Xinjiang, Xizang, Yunnan [Afghanistan, India, Japan, Kashmir, Korea, Mongolia, Pakistan, Russia; SW Asia (Armenia, Iran), Europe, North America].

The name *Galium boreale*, as used here in a wide sense, corresponds to a widespread and polymorphic, still insufficiently studied N Hemisphere polyploid complex (Ehrendorfer et al., Fl. Iranica 176: 179–181. 2005) within *G. sect. Platygaliium* s.l. In China, another species of this section with much smaller flowers, *G. kinuta*, can be separated from this *G. boreale* aggregate only with difficulties, because the two are linked by intermediate (and possibly hybrid) populations (see under *G. kinuta*).

Within the *Galium boreale* aggregate and the flora of China, W. C. Chen (in FRPS 71(2): 260–263, 285. 1999) recognized only *G. boreale* Linnaeus s.l. with numerous infraspecific taxa and *G. turkestanicum*, whereas 11 species in three series were listed for the flora of the former Soviet Union by Pobedimova et al. (Fl. URSS 23: 345–354. 1958). From these only *G. turkestanicum* is fully accepted here (*G. ussuriense* and *G. rubioides* are cited as synonyms under *G. boreale* var. *lanceolatum* and *G. boreale* var. *rubioides*). Furthermore, and according to Pobedimova et al. (loc. cit.), *G. amblyophyllum* Schrenk, *G. amurense* Pobedimova, and *G. septentrionale* Roemer & Schultes can be expected to occur in China. With the exception of the briefly mentioned *G. septentrionale*, they were not considered by W. C. Chen in FRPS and are only mentioned here. As a competent treatment of the *G. boreale* aggregate is not yet possible, we follow the schematic taxonomic differentiation proposed by Cufodontis (Oesterr. Bot. Z. 89: 225–228. 1940) and accepted by W. C. Chen (loc. cit.). This scheme defines numerous varieties according to leaf shape and the density, type, and distribution of indumentum on leaves, ovaries, and fruit. These varieties form a morphologically ± continuous series, linking the extremes: *G. boreale* var. *rubioides* with large ovate leaves and a broadly paniculate inflorescence and *G. boreale* var. *intermedium* with much smaller lanceolate leaves and an elongated narrow inflorescence. The following key and short descriptions are presented here for reference, to facilitate comparison, and to stimulate future studies.

- 1a. Ovary and fruit glabrous.
  - 2a. Leaf blade pilose or scabrous abaxially at least along veins.
    - 3a. Leaf blade linear-lanceolate or narrowly lanceolate ..... 7h. var. *lancilimbus*
    - 3b. Leaf blade ovate-lanceolate or ovate ..... 7k. var. *rubioides*
  - 2b. Leaf blade glabrous abaxially.
    - 4a. Leaf blade linear-lanceolate or narrowly lanceolate .... 7d. var. *hyssopifolium*
    - 4b. Leaf blade broadly lanceolate or ovate-lanceolate ..... 7g. var. *lanceolatum*
- 1b. Ovary and fruit ± hairy.
  - 5a. Ovary and fruit sparsely hirtellous or scabrous.
    - 6a. Leaf blade linear-lanceolate or narrowly lanceolate ..... 7e. var. *intermedium*
    - 6b. Leaf blade broadly lanceolate or ovate-lanceolate ..... 7j. var. *pseudorubioides*

5b. Ovary and fruit densely hirsute or tomentose.

- 7a. Leaf blade sparsely pubescent or scabrous at least along veins abaxially.
- 8a. Leaf blade linear-lanceolate or narrowly lanceolate ..... 7c. var. *ciliatum*
- 8b. Leaf blade broadly lanceolate or ovate-lanceolate .... 7f. var. *kamtschaticum*
- 7b. Leaf blade glabrous abaxially.
- 9a. Leaf blade less than 4 mm wide ..... 7b. var. *boreale*
- 9b. Leaf blade 4–15 mm wide.
- 10a. Leaf blade 4–6 mm wide ..... 7a. var. *angustifolium*
- 10b. Leaf blade wider than 6 mm ..... 7i. var. *latifolium*

**7a. *Galium boreale* var. *angustifolium*** (Freyn) Cufodontis, Oesterr. Bot. Z. 89: 226. 1940.

狭叶砧草 xia ye zhen cao

*Galium rubioides* Linnaeus var. *angustifolium* Freyn, Oesterr. Bot. Z. 45: 341. 1895.

Leaf blade narrowly lanceolate, 4–6 mm wide, abaxially glabrous. Ovary and mericarps densely hirsute or tomentose. Fl. Jun–Aug, fr. Jul–Sep.

Mountain slopes, river valleys, swamps, grasslands, meadows; 500–3900 m. Hebei, Heilongjiang, Nei Mongol, Sichuan, Xinjiang, Xizang [Japan, Kashmir, Russia; NE Europe].

**7b. *Galium boreale* var. *boreale***

北方拉拉藤(原变种) bei fang la la teng (yuan bian zhong)

*Galium boreale* var. *vulgare* Turczaninow.

Leaf blade narrowly lanceolate or linear-lanceolate, 1–3.9 mm wide, glabrous. Ovary and mericarps densely hirsute or tomentose with slightly curved, white trichomes. Fl. May–Aug, fr. Jun–Oct.

Forests, thickets, or tussocks on mountain slopes, ditch sides, grasslands, meadows; 700–3900 m. Gansu, Hebei, Heilongjiang, Jilin, Liaoning, Nei Mongol, Qinghai, Shandong, Shanxi, Sichuan, Xinjiang, Xizang [India, Korea, Pakistan, Russia; Europe, North America].

**7c. *Galium boreale* var. *ciliatum*** Nakai, J. Jap. Bot. 15: 340. 1939.

硬毛拉拉藤 ying mao la la teng

Leaf blade linear-lanceolate or narrowly lanceolate, 1–6 mm wide, abaxially sparsely hairy or scabrous at least along veins. Ovary and mericarps densely hirsute or tomentose. Fl. Jun–Sep, fr. Jul–Oct.

Mountain slopes, river beaches, ditch sides, open fields, meadows; 200–4600 m. Gansu, Hebei, Heilongjiang, Jilin, Liaoning, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shanxi, Sichuan, Xinjiang, Xizang, Yunnan [Japan, Russia; Europe (Finland, Romania), North America].

**7d. *Galium boreale* var. *hyssopifolium*** (Hoffmann) Candolle, Prodr. 4: 600. 1830.

斐梭浦砧草 fei suo pu zhen cao

*Galium hyssopifolium* Hoffmann, Deutschl. Fl., Dritter Jahrgang, 71. 1800; *G. boreale* f. *hyssopifolium* (Hoffmann) B. Boivin; *G. boreale* subsp. *hyssopifolium* (Hoffmann) Schübler & G. Martens; *G. rubioides* var. *hyssopifolium* (Hoffmann) Persoon.

Leaf blade linear-lanceolate or narrowly lanceolate, 1–6 mm wide, glabrous abaxially. Ovary and mericarps glabrous. Fl. and fr. Jun–Aug.

Mountain slopes, grasslands; 1800–2300 m. Sichuan, Xinjiang [Europe].

This variety probably has a wider geographic range.

**7e. *Galium boreale* var. *intermedium*** Candolle, Prodr. 4: 601. 1830.

新砧草 xin zhen cao

Leaf blade linear-lanceolate or narrowly lanceolate, 1–6 mm wide, sparsely pubescent to glabrescent. Ovary and mericarps sparsely hirtellous or scabrous. Fl. Jun–Jul, fr. Jul–Oct.

Mountain slopes, wastelands, forests, grasslands, meadows; 1500–1800 m. Gansu, Heilongjiang, Xinjiang [Russia; Europe].

**7f. *Galium boreale* var. *kamtschaticum*** (Maximowicz) Nakai, Bot. Mag. (Tokyo) 23: 103. 1909.

堪察加拉拉藤 kan cha jia la la teng

*Galium boreale* f. *kamtschaticum* Maximowicz, Mém. Acad. Imp. Sci. St.-Pétersbourg Divers Savans 9 [Prim. Fl. Amur.]: 141. 1859; *G. boreale* var. *koreanum* Nakai.

Leaf blade broadly lanceolate or ovate-lanceolate, 6–10 mm wide, abaxially sparsely hairy or scabrous at least along veins. Ovary and mericarps densely hirsute or tomentose. Fl. and fr. Jun–Sep.

Mountain slopes, farmland sides, riversides, river valleys, grasslands, meadows; 800–2400 m. Heilongjiang, Henan, Jilin, Liaoning, Nei Mongol, Shaanxi, Shanxi, Sichuan, Xinjiang [Kashmir, Korea, Mongolia, Russia; C Asia (“Turkestan”), NE Europe].

Nakai (Bot. Mag. (Tokyo) 23: 103. 1909) commented on Japanese plants and presented a key to *Galium*, including “*Galium boreale* var. *kamtschaticum* Maximowicz” with no further information. Some authors have considered this a validly published combination (e.g., in Go vaerts et al., World Checkl. Rubiaceae; <http://www.kew.org/wcsp/rubiaceae/>; accessed on 16 Nov 2007), whereas others have not (e.g., W. C. Chen, loc. cit.: 263) and have instead cited J. Coll. Sci. Imp. Univ. Tokyo 31: 498. 1911 (sometimes called Fl. Koreana 2) as the place of publication. Nakai’s new combination was indeed validly published in 1909 because, before 1953, merely citing an author’s name could constitute indication of a basionym (*Vienna Code*, Art. 33.2). Pobedimova et al. (loc. cit.: 419) erroneously attributed this varietal name to Maximowicz, 1859; it was published as a “forma” there.

**7g. *Galium boreale* var. *lancoletatum*** Nakai, J. Jap. Bot. 15: 341. 1939.

光果砧草 guang guo zhen cao

*Galium boreale* var. *leiocarpum* Nakai; *G. ussuriense* Pobedimova.

Leaf blade broadly lanceolate or ovate-lanceolate, 6–12 mm wide, glabrous abaxially. Ovary and mericarps glabrous. Fl. and fr. May–Sep.

Mountain slopes, open fields, grasslands; 900–1900 m. Heilongjiang, Jilin, Xinjiang [Korea, Russia; C Asia (“Turkestan”)].

Nakai’s two varieties were published simultaneously; the choice of epithet was apparently made by Cufodontis (Oesterr. Bot. Z. 89: 227. 1940).

**7h. *Galium boreale* var. *lancilimbum*** W. C. Chen, Acta Phytotax. Sin. 28: 302. 1990.

披针叶砧草 pi zhen ye zhen cao

Leaf blade linear-lanceolate or narrowly lanceolate, 1–6 mm wide, abaxially pilosulous or scabrous at least along veins. Ovary and mericarps glabrous. Fl. and fr. summer and autumn.

• Mountain slopes, grasslands, meadows, ditch sides, wastelands; 1800–3000 m. Gansu, Heilongjiang, Sichuan, Xinjiang.

**7i. *Galium boreale* var. *latifolium*** Turczaninow, Bull. Soc. Imp. Naturalistes Moscou 18: 315. 1845.

宽叶拉拉藤 kuan ye la la teng

Leaf blade ovate-lanceolate, 6–15 mm wide, glabrous abaxially. Ovary and mericarps densely hirsute or tomentose. Fl. and fr. Jun–Sep.

Mountain slopes, grasslands, meadows, farmland sides, river beaches; 700–2700 m. Gansu, Heilongjiang, Jilin, Liaoning, Nei Mongol, Ningxia, Shanxi, Xinjiang [Kashmir, Korea, Russia; C Asia (“Turkestan”)].

**7j. *Galium boreale* var. *pseudorubioides*** Schur, Enum. Pl. Transsilv. 280. 1866.

假茜砧草 jia qian zhen cao

*Galium boreale* subsp. *pseudorubioides* (Schur) Soó.

Leaf blade broadly lanceolate or ovate-lanceolate, 5–12 mm wide, sparsely pubescent to glabrescent abaxially. Ovary and mericarps sparsely hirtellous or scabrous. Fl. and fr. Jun–Jul.

Mountain slopes, meadows; ca. 1400 m. Heilongjiang, Jilin, Xinjiang [Russia; C Asia (“Turkestan”), Europe].

**7k. *Galium boreale* var. *rubioides*** (Linnaeus) Čelakovsky, Prodr. Fl. Böhmen 2: 281. 1872.

茜砧草 qian zhen cao

*Galium rubioides* Linnaeus, Sp. Pl. 1: 105. 1753.

Leaf blade ovate-lanceolate or ovate, 4–6 mm wide, abaxially pilosulous or scabrous at least along veins. Ovary and mericarps glabrous. Fl. and fr. Jun–Sep.

Mountain slopes, grasslands; 1100–1400 m. Hebei, Heilongjiang, Henan, Jilin, Liaoning, Xinjiang [Russia; Europe].

This broad- and large-leaved taxon is quite distinct from *Galium boreale* s.s. in Europe and is usually treated there as a separate species. Contrary to the above distribution data given by W. C. Chen (loc. cit.: 261) and according to Pobedimova et al. (loc. cit.: 420) it does not extend into Asia.

**8. *Galium bullatum*** Lipsky, Trudy Imp. S.-Peterburgsk. Bot. Sada 13: 300. 1894.

泡果拉拉藤 pao guo la la teng

Subshrubs, perennial, erect or ascending, sometimes caespitose, 5–40 cm tall. Rootstock stout, woody. Stems 4-angled, very shortly pilose at base, glabrous and smooth above. Leaves in whorls of 5–8, drying blackish, linear to linear-oblong, 12–27 × 1–2 mm, glabrous or sparsely ciliolate toward acute apex; vein 1. Inflorescences terminal on main and short lateral branches, cymose to corymbiform, lax, few to several flowered; axes glabrous and smooth; bracts reduced or none; pedicels 1–4 mm. Ovary ovoid, ca. 1.5 mm, glabrous. Corolla white, cup-shaped to subrotate, 3.5–5 mm in diam., glabrous; lobes 4, lanceolate-oblong, slightly mucronulate. Fruit usually from 1 mericarp only, subglobose, 3–3.5 mm in diam., glabrous, smooth, white, with pericarp inflated, spongy to ± fleshy. Fl. Jun–Jul, fr. Jul–Aug.

Grasslands, meadows; ca. 500 m. ?Xinjiang [SW Asia (Armenia, ?Iran, Nakhichevan)].

*Galium bullatum* is a member of *G. sect. Orientaligium* centered in SW Asia and characterized by slightly cup-shaped corollas, never retrorsely aculeolate stems, etc. The above diagnosis is taken from the original description and a collection by Szovits in W (“in Persia borealis”). We have not seen a specimen from China. The description by W. C. Chen (in FRPS 71(2): 274. 1999), evidently based on plants from Xinjiang, deviates from the authentic material in W by describing the stems as retrorsely hispidulous along angles and the corolla as rotate. Species of *G. sect. Orientaligium* usually are rather locally distributed (Ehrendorfer et al., Fl. Iranica 176: 205–231. 2005), and the distance between Nakhichevan and Xinjiang is enormous. All this makes it quite unlikely that *G. bullatum* (or even other related members of *G. sect. Orientaligium*) really occurs in China. A definite decision has to wait until voucher specimens become available for comparison.

**9. *Galium bungei*** Steudel, Nomencl. Bot., ed. 2, 1: 657. 1840.

四叶律 si ye lu

Herbs, perennial, 5–50 cm tall, erect from tender reddish rootstock or filiform rhizome. Stems often caespitose, 4-angled, unbranched or little branched, smooth, glabrous and smooth or pilosulous to pilose, rarely retrorsely aculeolate, at nodes ± hispidulous. Leaves in whorls of 4, subsessile; blade drying papery, ovate-oblong, ovate-lanceolate, lanceolate-oblong, elliptic-oblong, or narrowly oblanceolate, (6–)8–20(–34) × (2–)3–7(–10) mm, length/breadth index usually 3–5, glabrous and sometimes antrorsely aculeolate on midrib and near margins, to pilosulous or pilose throughout, lower side sometimes glandular-punctate or striate, base cuneate, apex acute or slightly obtuse; 1 principal vein, 2 lateral veins usually inconspicuous. Inflorescences terminal and/or axillary, cymose to paniculate, congested to lax, cymes few to several flowered, 1–5 cm; peduncles glabrous, smooth; bracts none or few, spatulate to narrowly elliptic, 1–5 mm; pedicels (1–)2–4(–7) mm. Ovary subglobose to ellipsoid, laterally somewhat flattened, 0.4–0.8 mm, glabrous to strigillose, smooth to tuberculate. Corolla yellowish green or white, rotate, 1.5–2.5 mm in diam., glabrescent; lobes 4, ovate or oblong, acute to acuminate. Mericarps ellipsoid, 1–2 mm, tuberculate, aculeolate or with appressed and curved to spreading and uncinat trichomes ca. 0.3 mm, rarely glabrous and smooth. Fl. Apr–Sep, fr. May–Jan.

Forests, thickets, or meadows on mountains, hills, open fields, farmlands, ditch sides, riversides and beaches, streamsides; near sea level to 3600 m. Anhui, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Liaoning, Nei Mongol, Ningxia, Shaanxi, Shandong, Shanxi, Sichuan, Taiwan, Yunnan, Zhejiang [Japan, Korea].

*Galium bungei* designates a group of tender perennial herbs from *G.* sect. *Platygalium*, widespread and common at low to middle elevations throughout China. *Galium bungei* is also used medicinally there. The group is very variable with respect to habit and inflorescence, as well as stem, leaf, and fruit indumentum (the latter from tuberculate to spreading hooked trichomes). The small and inconspicuous flowers suggest autogamous reproduction. All this has caused the recognition of several "species." In view of the gradual nature of this variation and the partly simple genetic basis of the underlying differences, we give them less taxonomic weight, follow Cufodontis (Oesterr. Bot. Z. 89: 219–223. 1940) and the Kew Rubiaceae checklist (Govaerts et al., World Checkl. Rubiaceae; <http://www.kew.org/wcsp/rubiaceae/>; accessed on 15 Sep 2010), and include them all as synonyms under *G. bungei* s.l. Only the closely related *G. salvinense*, endemic in Sichuan and Yunnan, is maintained on the basis of its elongated and slender pedicels and the constant hooked fruit trichomes.

Forms of *Galium bungei* with broader leaves in Sichuan (e.g., var. *punduanoides*) develop, in addition to the principal vein, stronger side veins somewhat approaching the larger *G. yunnanense*, typically with 3-veined leaves, which occurs in the same area.

To bring some schematic order into the extreme variation of a broadly circumscribed *Galium bungei* s.l., Cufodontis (loc. cit.: 221–222) created six varieties, without giving much weight to differences in fruit surface. These varieties were taken up by W. C. Chen in FRPS (71(2): 247–250. 1999) and are also presented here. In contrast to this approach, Yamazaki (J. Jap. Bot. 61: 51. 1991; Fl. Japan 3a: 236–237. 1993) recognized several of these varieties as species for the *Flora of Japan*: *G. pogonanthum* (corresponding to *G. bungei* var. *setuliflorum*), separated by having appressed upcurved short hairs on its fruit rather than spreading hooked trichomes as *G. bungei* s.s.; *G. gracilens* (corresponding to *G. bungei* var. *bungei*), characterized by short appressed punctate fruit hairs and slender inflorescences; and *G. trachyspermum* (corresponding to *G. bungei* var. *trachyspermum*), with short appressed hooked fruit hairs and more condensed inflorescences. For each of these segregate species Yamazaki (loc. cit. 1991; loc. cit. 1993) also created several new additional varieties not considered here. For their treatment of Taiwanese members of *G. bungei* s.l. Yang and Li (Bull. Natl. Mus. Nat. Sci., Taichung 11: 105–106. 1998; Fl. Taiwan, ed. 2, 4: 255–256. 1998) accepted two species: *G. gracilens* with tuberculate fruit and *G. fukuyamae* with appressed uncinat fruit hairs. Below, we present the schematic infraspecific classification of W. C. Chen in FRPS. Descriptions are sketchy due to the limited material available. Nevertheless, this may help as a reference and basis for urgently needed future studies on this polymorphic and phylogenetically important group.

- 1a. Stems pubescent.
  - 2a. Pubescence with trichomes shorter than diam. of stems ..... 9c. var. *hispidum*
  - 2b. Pubescence with trichomes longer than diam. of stems ..... 9d. var. *punduanoides*
- 1b. Stems glabrous, hairy only at nodes.
  - 3a. Corolla lobes sparsely pubescent at least in bud ..... 9e. var. *setuliflorum*
  - 3b. Corolla lobes glabrous.
    - 4a. Leaf blade broadly elliptic, obovate, or broadly lanceolate;

inflorescences crowded, congested to subcapitate

- ..... 9f. var. *trachyspermum*
- 4b. Leaf blade narrowly lanceolate, linear-lanceolate, or ovate-lanceolate; inflorescences lax.
  - 5a. All leaves narrowly lanceolate or linear-lanceolate, to 3 cm ..... 9a. var. *angustifolium*
  - 5b. Lower stem leaves ovate-lanceolate, upper stem leaves narrower, often less than 2 cm ..... 9b. var. *bungei*

**9a. *Galium bungei* var. *angustifolium*** (Loesener) Cufodontis, Oesterr. Bot. Z. 89: 221. 1940.

狭叶四叶律 xia ye si ye lü

*Galium gracile* f. *angustifolium* Loesener, Beih. Bot. Centralbl., Abt. 2, 37: 182. 1920.

Leaf blade narrowly lanceolate or linear-lanceolate, to 3 cm. Fl. Jun–Jul, fr. Aug–Oct.

• Anhui, Fujian, Gansu, Hebei, Henan, Jiangsu, Jiangxi, Shaanxi, Shandong, Shanxi, Zhejiang.

**9b. *Galium bungei* var. *bungei***

四叶律(原变种) si ye lü (yuan bian zhong)

*Galium fukuyamae* Masamune; *G. gracile* Bunge (1833), not Wallroth (1822); *G. gracile* var. *miltorrhizum* (Hance) Loesener; *G. gracilens* (A. Gray) Makino; *G. lutchuense* Nakai; *G. miltorrhizum* Hance; *G. remotiflorum* H. Léveillé & Vaniot; *G. trachyspermum* A. Gray var. *gracilens* A. Gray.

Stems glabrous. Leaf blade ovate-lanceolate at lower part, attenuate at upper part. Inflorescence paniculate and lax. Corolla glabrous. Fl. Apr–Sep, fr. May–Jan.

Forests or meadows on hills or mountains, open fields, farmlands, ditch sides; below 100–2600 m. Anhui, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Liaoning, Nei Mongol, Ningxia, Shaanxi, Shandong, Shanxi, Sichuan, Taiwan, Yunnan, Zhejiang [Japan, Korea].

**9c. *Galium bungei* var. *hispidum*** (Matsuda) Cufodontis, Oesterr. Bot. Z. 89: 222. 1940.

硬毛四叶律 ying mao si ye lü

*Galium gracile* f. *hispidum* Matsuda, Bot. Mag. (Tokyo) 26: 130. 1912; ?*G. martini* H. Léveillé & Vaniot; *G. trachyspermum* var. *hispidum* (Matsuda) Kitagawa.

Stems soft pubescent, trichomes shorter than diam. of stem. Fl. Apr–Jun, fr. May–Sep.

• Forests or meadows on mountain slopes, river beaches, open fields; 100–3400 m. Anhui, Fujian, Gansu, Henan, Hubei, Jiangsu, Shaanxi, Shanxi, Sichuan, Yunnan, Zhejiang.

In the protologue Cufodontis correctly cited the basionym of his variety but incorrectly gave his varietal name as “var. *hispidum* (Kitag.) Cufodontis” when the basionym author was actually Matsuda.

*Galium martini* was accepted as a dubious species by W. C. Chen in FRPS (loc. cit.: 282). The protologue (Bull. Soc. Bot. France 55: 58. 1908) is quite incomplete but probably refers to a strongly hairy plant of *G. bungei* s.l. from Guizhou. Therefore, the name is provisionally placed here as a possible synonym of var. *hispidum* or var. *punduanoides* until a detailed study of the type (E) will clarify the matter.

**9d. *Galium bungei* var. *punduanoides*** Cufodontis, Oesterr. Bot. Z. 89: 222. 1940.

毛四叶律 mao si ye lu

?*Galium martini* H. Léveillé & Vaniot.

Stem soft to stiffly pubescent, trichomes longer than diam. of stems. Inflorescence often more congested and terminal. Fl. Jun–Jul, fr. Jul–Aug.

• Forests, thickets, or meadows on mountains, open fields, riversides; 900–3600 m. Gansu, Jiangsu, Sichuan, Yunnan.

**9e. *Galium bungei* var. *setuliflorum*** (A. Gray) Cufodontis, Oesterr. Bot. Z. 89: 221. 1940.

毛冠四叶律 mao guan si ye lu

*Galium trachyspermum* var. *setuliflorum* A. Gray, Mem. Amer. Acad. Arts, n.s., 6: 393. 1859; *G. pogonanthum* Franchet & Savatier; *G. pogonanthum* var. *setuliflorum* (A. Gray) H. Hara; *G. setuliflorum* (A. Gray) Makino.

Corolla lobes sparsely pubescent at least in bud.

Jiangsu, Shanxi [Japan, Korea].

**9f. *Galium bungei* var. *trachyspermum*** (A. Gray) Cufodontis, Oesterr. Bot. Z. 89: 221. 1940.

阔叶四叶律 kuo ye si ye lu

*Galium trachyspermum* A. Gray in Perry, Narr. Exped. China Japan 2: 313. 1856; *G. venosum* H. Léveillé.

Leaf blade broadly elliptic, obovate, or broadly lanceolate. Inflorescences congested to subcapitate. Fl. Apr–May, fr. Apr–Jul.

Forests or meadows on hills, open fields, streamsides; near sea level to 800 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hebei, Hubei, Hunan, Jiangsu, Jiangxi, Shaanxi, Shandong, Sichuan, Zhejiang [Japan, Korea].

**10. *Galium chekiangense*** Ehrendorfer, Novon 20: 270. 2010.

浙江拉拉藤 zhe jiang la la teng

Herbs, perennial, with thin rhizomes. Stems 2–4 from a common base, erect, usually unbranched, 20–30(–40) cm tall, with only 4 or 5 internodes from base to first inflorescence node, with 4 prominent, rounded, and whitish angles, glabrous and smooth except for short and stiff hairs at nodes. Leaves and leaflike stipules in whorls of 4, sessile; blade drying somewhat leathery and light brownish green, broadly elliptic to ovate, (15–)23–30(–50) × (8–)11–15(–25) mm, length/breadth index 2.5 or less, gradually narrowed into base, broadest near middle, gradually narrowed into apex, mostly

shortly apiculate but without a hyaline point, glabrous except for antrorse microhairs (0.1–0.2 mm) along 3 main veins, mostly on lower but also on upper side and along slightly revolute margins, papillose on upper side under a strong lens (20×), lower side clearly marked by numerous darker and linear idioblasts. Inflorescences loosely thyrsoid and elongate, from uppermost 2 or 3 nodes, clearly longer than subtending leaves, cymes lateral and terminal, somewhat divaricate, 1–4 cm, with few and inconspicuous linear bracts and rather few flowered; peduncles 1–2 cm and pedicels 0.1–1 cm. Ovary obovoid, 0.8–1 mm. Corolla greenish white, rotate, ca. 3 mm in diam., glabrous; lobes 4, acuminate. Ripe mericarps ovoid, 1.5–2(–3) mm, densely covered by stiff and appressed to slightly divergent microhairs, 0.15–0.25 mm and with an acute and ± bent apex. Fl. Jul, fr. Aug.

• Lower montane forests; ca. 1400 m. Fujian, Zhejiang.

Specimens of *Galium chekiangense* from the province of Fujian were included and described in FRPS (71(2): 265. 1999) under the name of *G. nakaii* Kudô ex H. Hara (J. Jap. Bot. 9: 517. 1933). These Fujian vouchers were not available, but two fruiting specimens from the adjacent province of Zhejiang (formerly Chekiang: Xi ming shan) in the herbarium PE could be studied. They were determined as “*G. kamschaticum*” and closely correspond to the description of *G. nakaii* in FRPS. These PE specimens deviate clearly from authentic Japanese specimens of *G. nakaii* as well as from *G. kamschaticum* and *G. oreganum* Britton. This has justified the description of *G. chekiangense* as a new and endemic Chinese species and makes *G. nakaii* an endemic of Japan.

*Galium chekiangense* clearly belongs to *G.* sect. *Platygalium* s.l. (Ehrendorfer et al., Fl. Iranica 176: 175. 2005) and apparently is a member of the *G. kamschaticum* species group, which includes the amph-Beringian *G. kamschaticum* (in China limited to elevations of 1500–2300 m in the NE provinces of Heilongjiang and Jilin), the Japanese *G. nakaii* from Hokkaido and N Honshu, and the W North American *G. oreganum*. These three latter species differ from *G. chekiangense* by their leaf blades drying dark brownish (not light brownish green), thin, membranous and smooth, neither papillose above nor with glandular-striate idioblasts below, and by their ripe mericarps with much longer uncinat trichomes (0.8–1 mm, not 0.15–0.25 mm). In addition, *G. nakaii* has inflorescence cymes mostly shorter (not clearly longer) than the subtending leaves.

For further and more detailed studies of the *Galium kamschaticum* group, one should refer to the wide circumscription of *G. kamschaticum* (with three varieties) and the confused, partly contradictory description of the fruit indumentum of *G. nakaii* in Yamazaki (Fl. Japan 3a: 234–235. 1999).

**11. *Galium consanguineum*** Boissier, Diagn. Pl. Orient., ser. 1, 6: 69. 1846.

卷边拉拉藤 juan bian la la teng

*Galium consanguineum* subsp. *majmechense* (Bordzilowski) A. D. Mikheev; *G. majmechense* Bordzilowski; *G. verum* Linnaeus var. *consanguineum* (Boissier) Boissier.

Herbs, perennial, often caespitose from a stout and woody rootstock with rhizomes. Stems erect, to 1 m tall, 4-angled, glabrous to puberulent at least at nodes, smooth. Leaves in whorls of 6–12, sessile; blade drying papery, linear-oblongate to linear, 20–28 × 1–3 mm, glabrous, more rarely ± hairy,

base acute to straight, margin shortly to strongly revolute and usually antrorsely aculeolate, apex acute and mucronate; vein 1. Inflorescences narrowly paniculate with main stems and short lateral and terminal, few- to several- or many-flowered, rather congested cymes; peduncles glabrous, smooth; pedicels 0.5–3 mm, subtended by leaflike bracts. Ovary subglobose to obovoid, 0.5–0.8 mm, smooth, glabrous or ± hispidulous with straight hairs. Corolla yellow, rotate, ca. 3 mm in diam., glabrous, lobed for 3/4 or more; lobes 4(or 5), lanceolate-oblong, acute to acuminate. Mericarps ellipsoid to obovoid, ca. 1.5 × 1 mm, glabrous or ± hispidulous with straight trichomes. Fl. Jul–Aug, fr. Aug–Sep.

Thickets; [1300–]1700[–2800] m. Xinjiang [SW Asia (Armenia, Azerbaijan, Iran, Iraq, Lebanon, E Turkey)].

*Galium consanguineum* was treated as *G. majmechense* (a younger synonym) by W. C. Chen (FRPS 71(2): 269. 1999). It belongs to the polymorphic *G. verum* group or complex (see additional comments under that species) and apparently links it (as a hybrid taxon?) to more broadly leaved and glabrous members of *G.* sect. *Orientigalium* (Ehrendorfer et al., Fl. Iranica 176: 205–207. 2005). *Galium consanguineum* can be separated from *G. verum* by its broader (more than 2.5 mm), ± glabrous leaves, but intermediates occur.

**12. *Galium crassifolium*** W. C. Chen, Acta Phytotax. Sin. 28: 299. 1990.

厚叶拉拉藤 hou ye la la teng

Herbs, perhaps perennial, ascending, ca. 10 cm tall. Stems 4-angled, caespitose, glabrous and smooth or sparsely puberulent. Leaves in whorls of 4, sessile or subsessile; blade drying leathery, elliptic or ovate, 3–8 × 2–4 mm, scabrous with microhairs, base cuneate or subobtuse, margins antrorsely ciliolate, apex obtuse and mucronate; vein 1. Inflorescences terminal and/or axillary, cymose, few flowered, up to 1 cm; axes glabrous and smooth, somewhat bracteate; pedicels ca. 1 mm. Flowers unknown. Mericarps ovoid, 0.5–1 mm, with appressed, slightly curved microhairs, ca. 0.3 mm. Fl. Aug–Sep, fr. Oct.

- Valleys, open habitat; ca. 800 m. Shanxi (Zhenba).

We have seen no authentic material of *Galium crassifolium*, but the original description is accompanied by a good drawing. In the protologue similarities with the Taiwanese *G. tarokoense* are suggested. Both species are distantly related, but apparently *G. crassifolium* falls within the morphological amplitude of the polymorphic *G. bungei*. Its distinctness with respect to reduced plants from dry habitats should be checked in the future.

**13. *Galium dahuricum*** Turczaninow ex Ledebour, Fl. Ross. 2: 409. 1844.

大叶猪殃殃 da ye zhu yang yang

Herbs, perennial, from a slender reddish rootstock. Stems erect to ascending, weak to procumbent and often climbing, sometimes up to 2.5 m, 4-angled, sparsely to densely retrorsely aculeolate along angles and at nodes, rarely ± glabrescent. Leaves on main stems in whorls of 5 or 6, subsessile; blade drying papery, of very variable shape, from obovate and elliptic-oblong to narrowly oblanceolate, (11–)15–40(–55) × (2–)3–10(–14), sparsely to densely retrorsely aculeolate adaxially along midrib, abaxially, and along flat to thinly reflexed mar-

gins, base acute to cuneate, apex acute to obtuse and mucronate; vein 1. Inflorescences paniculate, with axillary and terminal, several- to many-flowered, usually very lax and up to 7 cm long cymes; axes filiform and often flexuous, sparsely aculeolate to glabrous; bracts few, lanceolate; pedicels slender, in flower 2–5 mm. Ovary obovoid, ca. 0.8 mm, with dense spreading or appressed undeveloped trichomes, or glabrous. Corolla white or pale green, rotate, of quite different sizes, (1–)1.5–3(–4) mm in diam., glabrous; lobes 4, triangular, obtuse to acute or minutely apiculate. Mericarps ellipsoid, ca. 2 mm, with appressed or spreading and uncinat trichomes (0.3–0.5 mm), tuberculate to completely glabrous and smooth, on pedicels elongating to 10 mm or more. Fl. Jun–Sep, fr. Jul–Nov.

Humid forests, thickets, ditch sides, grasslands, meadows; 200–3400 m. Fujian, Gansu, Guizhou, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Jilin, Liaoning, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shanxi, Sichuan, Xinjiang, Xizang, Yunnan, Zhejiang [Japan, Korea, Russia].

Within *Galium* sect. *Trachygalium* and the extremely polymorphic species group of *G. asperifolium* (see there) Cufodontis (Oesterr. Bot. Z. 89: 239–243. 1940), Yamazaki (Fl. Japan 3a: 206–240. 1993), and W. C. Chen (in FRPS 71(2): 255–258. 1999) differentiated the closely related taxa *G. dahuricum* (in FRPS as “*G. davuricum*,” the spelling used in the protologue by Ledebour), *G. tokyoense*, *G. pseudoasprellum*, and *G. manshuricum* mainly according to the lack (in the two former) and the presence (in the two latter) of appressed or spreading uncinat trichomes on the mericarps. As this character apparently often varies within populations of these taxa, the present treatment relies on the much more stable feature of slender, filiform, and ± flexuose vs. more stiff and divaricate peduncles and pedicels. The former state characterizes *G. dahuricum* (including *G. manshuricum* and *G. pseudoasprellum*), the latter *G. tokyoense*. This species assembly has its distribution center in E Asia but extends with *G. asprellum* Michaux s.s. into E North America.

*Galium pseudoasprellum* was accepted as a species by Cufodontis (loc. cit.: 237–238), W. C. Chen (loc. cit.: 254–255), and Yamazaki (loc. cit.: 238), and the latter two also maintained *G. niewerthii*. In our opinion and because of their similar inflorescences, both taxa should be regarded as synonyms of *G. dahuricum*, the former under var. *lasiocarpum*, the latter under var. *dahuricum*. Even if we have not seen authentic specimens of *G. niewerthii*, all of its characters listed fall within the limits of *G. dahuricum*; thus, we regard it as a glabrous-fruited form of that variable species. So far, *G. comarii* has been a badly understood taxon (see Cufodontis, loc. cit.: 241; Lauener, Notes Roy. Bot. Gard. Edinburgh 32: 107. 1972; Mill, Edinburgh J. Bot. 53: 193–213. 1996). Because of its slender inflorescence, extremely long pedicels, and rugose fruit mentioned in the protologue, it can now be safely assigned as another synonym of *G. dahuricum* var. *dahuricum*.

The following infraspecific taxa of *Galium dahuricum* (and *G. pseudoasprellum*), accepted by Cufodontis (loc. cit.: 237–238, 243–244) and W. C. Chen (loc. cit.), are keyed and listed here for comparison.

- 1a. Ovary and mericarps glabrous or tuberculate ..... 13a. var. *dahuricum*
- 1b. Ovary and mericarps with spreading or appressed uncinat trichomes.
  - 2a. Inflorescences with loosely branched cymes, with filiform and ± flexuose pedicels of up to 5 mm, in fruit up to 10 mm ..... 13b. var. *lasiocarpum*

- 2b. Inflorescences more congested, pedicels shorter than 5 mm ..... 13c. var. *densiflorum*

**13a. *Galium dahuricum* var. *dahuricum***

大叶猪殃殃(原变种) da ye zhu yang yang (yuan bian zhong)

*Galium asprellum* Michaux var. *dahuricum* (Turczaninow ex Ledebour) Maximowicz; *G. comarii* H. Léveillé & Vaniot; *G. dahuricum* var. *leiocarpum* Nakai; *G. niewerthii* Franchet & Savatier.

Stems and nodes often ± glabrescent. Leaf blade with margins ± retrorsely aculeolate. Inflorescences lax; peduncles and pedicels strongly elongated. Ovary and mericarps glabrous or tuberculate. Fl. Jun–Jul, fr. Aug–Oct.

Forests, grasslands; 700–1000 m. Fujian, Guizhou, Hebei, Heilongjiang, Hubei, Hunan, Jilin, Liaoning, Nei Mongol, Sichuan, Xinjiang, Yunnan [Korea, Russia].

This variety was listed as *Galium niewerthii* for the *Flora of Japan* (Yamazaki, loc. cit.: 238). Forms with many-flowered inflorescences, somewhat shorter pedicels, and glabrous ovaries and fruit have been seen from Yunnan; they apparently tend toward *G. asperifolium* and/or *G. prattii*. *Galium taiwanense* (see there) is very close to *G. dahuricum* var. *dahuricum* and evidently replaces it on Taiwan.

**13b. *Galium dahuricum* var. *lasiocarpum* (Makino) Nakai, J. Coll. Sci. Imp. Univ. Tokyo 31: 498. 1911.**

东北猪殃殃 dong bei zhu yang yang

*Galium asprellum* var. *lasiocarpum* Makino, Bot. Mag. (Tokyo) 17: 76. 1903; *G. dahuricum* var. *manshuricum* (Kitagawa) H. Hara; *G. manshuricum* Kitagawa; *G. pseudoasprellum* Makino.

Stem nodes and leaf blade retrorsely aculeolate. Inflorescences lax; peduncles and pedicels elongated. Ovary and mericarps with dense appressed or spreading uncinete trichomes. Fl. Jun–Jul, fr. Aug–Oct.

Forests, meadows, ditch sides; 300–1100 m. Gansu, Hebei, Heilongjiang, Henan, Jiangsu, Jilin, Liaoning, Qinghai, Shaanxi, Shanxi, Sichuan, Yunnan [Japan, Korea].

**13c. *Galium dahuricum* var. *densiflorum* (Cufodontis) Ehren-dorfer, Novon 20: 277. 2010.**

密花拉拉藤 mi hua la la teng

*Galium pseudoasprellum* var. *densiflorum* Cufodontis, Oesterr. Bot. Z. 89: 237. 1940.

Stems often lower and leaf blade smaller. Inflorescences shorter and more congested; pedicels rarely longer than 5 mm; bracts larger, similar to leaves. Ovary and mericarps with dense spreading uncinete trichomes. Fl. Jul–Aug, fr. Aug–Nov.

• Forests, thickets, meadows on mountains; 700–3400 m. Gansu, Guizhou, Hebei, Henan, Jiangxi, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shanxi, Sichuan, Xizang, Yunnan.

The above geographic indications for this variety are uncertain because of confusion with *Galium tokyoense*, etc. At least in part, *G. dahuricum* var. *densiflorum* may refer to transitional (?hybrid) forms of *G. dahuricum* var. *lasiocarpum* with *G. asperifolium*, *G. blinii*, *G. prattii*, and/or *G. sungpanense*.

**14. *Galium echinocarpum* Hayata, J. Coll. Sci. Imp. Univ. Tokyo 30(1): 147. 1911.**

刺果猪殃殃 ci guo zhu yang yang

Herbs, perennial, emerging from reddish, filiform rhizomes. Stems ascending to erect, 10–40 cm tall, 4-angled, glabrous and smooth. Leaves in whorls of (4 or)5 or 6, subsessile; blade drying papery, oblanceolate, obovate, narrowly elliptic, or narrowly oblanceolate, 6–25 × 2–7 mm, glabrous or sometimes sparsely hispid to strigillose, base acute, margins flat, smooth or antorsely aculeolate, apex acute to obtuse or rounded and abruptly mucronate; vein 1. Inflorescences terminal and in axils of upper leaves, with lax, few- to several-flowered cymes; axes glabrous, smooth; bracts none or leaflike, 2–6 mm; pedicels 0.5–2 mm. Ovary subglobose, 0.5–0.7 mm, densely strigillose with undeveloped trichomes. Corolla white, rotate, ca. 2 mm in diam., glabrous, lobed for 3/4 or more; lobes 4, triangular, apex obtuse. Mericarps subglobose to ellipsoid, ca. 2 mm, with dense uncinete trichomes ca. 1 mm, on pedicels elongating to 10 mm. Fl. May, fr. May–Dec.

• Montane forest regions, grassy fields, along drainage ditches; 900–3500 m. Taiwan.

*Galium echinocarpum* is very similar to *G. hoffmeisteri* and replaces it on Taiwan. *Galium takasagomontanum* may belong here as a synonym (see there).

**15. *Galium elegans* Wallich in Roxburgh, Fl. Ind. 1: 382. 1820.**

小红参 xiao hong shen

Herbs, perennial, climbing or procumbent to usually erect, 0.1–1 m tall, from a slender rootstock with purplish rhizomes. Stems somewhat stout, 4-angled, smooth, sparsely to densely hirsute, villous, or villosulous and often densely puberulent at nodes, angles thickened. Leaves in whorls of 4, subsessile or petiole to 1.5 mm; blade drying papery to leathery, green to gray, or dark brown, ovate to broadly elliptic, 6–30 × 3–20 mm, length/breadth index mostly 2 or less, sparsely to densely hirtellous, or hispidulous to scaberulous at least on principal veins, abaxially often glandular-punctate and/or -striate, base rounded to acute, margins antorsely ciliate to ciliate and flat to thinly revolute, apex rounded to obtuse; principal veins palmate, 3(or 5). Inflorescences thyrsoid to paniculiform, with several- to many-flowered, 2–10 cm long cymes in uppermost leaf axils and terminal; peduncles glabrescent to sparsely scaberulous, hirtellous, puberulent, or villosulous; bracts narrowly spatulate to narrowly elliptic, 1–3 mm; pedicels 0.5–2.5 mm. Flowers dioecious, polygamo-dioecious, or sometimes ?hermaphroditic. Ovary obovoid, in staminate flowers ca. 0.5 mm and glabrous to scaberulous or sparsely strigillose, in pistillate and bisexual flowers 0.8–1 mm and usually moderately to densely strigillose, particularly on their lateral side. Corolla white or pale yellow, rotate, 2–2.5 mm in diam., glabrous; lobes 4, ovate-triangular, acute to rounded. Mericarps ellipsoid, 1–1.5 mm, with sparse to dense and spreading uncinete trichomes 0.5–0.8 mm, rarely scaberulous or glabrous. Fl. Apr–Aug(–Oct), fr. May–Dec.

Forests, thickets, meadows on mountain slopes, streamsides, open fields, on rocks; 200–3500 m. Anhui, Fujian, Gansu, Guangxi, Guizhou,

Hunan, Qinghai, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [Bangladesh, Bhutan, India, Kashmir, Myanmar, Nepal, Pakistan, Thailand].

*Galium elegans* is a widely ranging, polymorphic species that may not be completely distinct from several other related taxa. It is here circumscribed more narrowly than by Cufodontis (Oesterr. Bot. Z. 89: 228–232. 1940) and W. C. Chen (in FRPS 71(2): 242–245. 1999), which reduces its variation a bit. These aspects are discussed below.

Plants with narrower leaves are separated here as *Galium yunnanense*. This species comprises two of the varieties included by Cufodontis in *G. elegans*, i.e., *G. elegans* var. *angustifolium* and *G. elegans* var. *nemorosum*. Separation of the two taxa is not always easy, as transitional specimens occasionally occur.

Plants of *Galium elegans* with shortened pedicels and more congested cymes (e.g., from Sichuan, Shimian Xian) may approach the Himalayan *G. confertum* Royle ex J. D. Hooker.

*Galium nephrostigmaticum* was described as a species by Diels, an opinion still maintained by some authors. Here, it is treated as a variety of *G. elegans*, following W. C. Chen (Acta Phytotax. Sin. 28: 301. 1990) who referred to its glabrous to scaberulous ovaries and fruit, as noted in Diels's protologue. In contrast to this, Cufodontis (loc. cit.) synonymized *G. nephrostigmaticum* with *G. elegans* var. *elegans*. In an extensive discussion he demonstrated that *G. elegans* is dioecious and that *G. nephrostigmaticum* was based on a male plant with staminate flowers and reduced glabrous to smooth ovaries and sessile stigmas. In contrast, pistillate flowers of *G. elegans* have hairy ovaries and fruit, well-developed styles, and reduced stamens. Thus, according to Cufodontis, *G. nephrostigmaticum* does not merit taxonomic recognition. Ehrendorfer et al. (Fl. Iranica 176: 177. 2005) did not contradict the conclusions of Cufodontis but noted that some plants of *G. elegans* are monoecious or have bisexual flowers. This shows that the reproductive biology of this species apparently is more complex than thought before. Provisionally, *G. nephrostigmaticum* is treated here as a variety, pending more detailed studies of this critical group.

The still uncertain relationships between *Galium elegans* on the Chinese mainland and *G. formosense* on Taiwan are discussed under the latter taxon. In the present treatment their separation is maintained provisionally.

The traditional varieties of *Galium elegans* are separated schematically by the density, type, and distribution of the indumentum on the vegetative organs and have doubtful taxonomic value. W. C. Chen in FRPS (loc. cit.) also used leaf size and apex shape as characters to differentiate these varieties. For reference and to facilitate comparison with other works, we present a key to these infraspecific taxa below.

- 1a. Ovary (and fruit?) glabrous to scaberulous ..... 15c. var. *nephrostigmaticum*
- 1b. Ovary and fruit with ± uncinata trichomes.
  - 2a. Leaf blades in middle stem region ovate-lanceolate, length/breadth index 2–2.5, apex acute or obtuse and shortly acuminate, with a dense and fine indumentum ..... 15d. var. *velutinum*
  - 2b. Leaf blade ovate to ovate-lanceolate or broadly elliptic, length/breadth index usually less than 2, apex usually obtuse or slightly acuminate.
    - 3a. Stems sparsely or densely hirsute; leaf blade small and

thickly textured, not black

when dry ..... 15a. var. *elegans*

- 3b. Stems pilose or glabrescent at least on upper parts; leaf blade often large and thinly textured, blackish brown when dry ..... 15b. var. *glabriusculum*

### 15a. *Galium elegans* var. *elegans*

小红参(原变种) xiao hong shen (yuan bian zhong)

*Galium petiolatum* Geddes.

Stems sparsely or densely hirsute. Leaf blade drying thickly textured, not black, ovate to ovate-lanceolate or broadly elliptic, length/breadth index usually less than 2, apex obtuse or slightly acuminate. Mericarps with spreading uncinata trichomes. Fl. Apr–Aug, fr. May–Dec.

Forests, thickets, meadows on mountain slopes, streamsides, open fields, on rocks; 600–3500 m. Anhui, Gansu, Guizhou, Hunan, Qinghai, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [Bangladesh, Bhutan, India, Kashmir, Myanmar, Nepal, Pakistan, Thailand].

### 15b. *Galium elegans* var. *glabriusculum* Requier ex Candolle, Prodr. 4: 600. 1830.

广西拉拉藤 guang xi la la teng

*Galium elegans* f. *glabriusculum* (Requier ex Candolle) H. Hara ex H. Ohba.

Stems pilose or glabrescent at least on upper parts. Leaf blade drying ± blackish brown, often thinly textured, ovate, ovate-lanceolate, or elliptic, 10–33 × 5–18 mm, length/breadth index usually 2 or less, apex mostly obtuse. Mericarps with spreading uncinata trichomes. Fl. Jul–Aug, fr. Jul–Oct.

Forests or meadows on mountains and at streamsides; 1100–2900 m. Guangxi, Guizhou, Sichuan, Xizang, Yunnan [India, Nepal].

We have not seen authentic material of this taxon.

### 15c. *Galium elegans* var. *nephrostigmaticum* (Diels) W. C. Chen, Acta Phytotax. Sin. 28: 301. 1990.

肾柱拉拉藤 shen zhu la la teng

*Galium nephrostigmaticum* Diels, Notes Roy. Bot. Gard. Edinburgh 5: 279. 1912.

Similar to *Galium elegans* var. *elegans*, but ovary (and fruit?) glabrous to scaberulous. Fl. Apr–Oct, fr. Aug–Dec.

• Forests, meadows; 200–3000 m. Gansu, Guizhou, Sichuan, Yunnan.

This taxon apparently refers to male plants only (see above).

### 15d. *Galium elegans* var. *velutinum* Cufodontis, Oesterr. Bot. Z. 89: 230. 1940.

毛拉拉藤 mao la la teng

*Galium mairei* H. Léveillé.

Plants densely and finely pubescent, trichomes slender, spreading. Leaf blade lanceolate or ovate-lanceolate, 7–15 × ca.

3 mm, length/breadth index 2–2.5, apex acute or obtuse and shortly acuminate. Mericarps with spreading uncinat trichomes. Fl. and fr. Jul.

• Meadows or on rocks on mountain slopes; 2100–2300 m. Sichuan, Yunnan.

**16. *Galium exile*** J. D. Hooker, Fl. Brit. India 3: 207. 1881.

单花拉拉藤 dan hua la la teng

*Galium handelii* Cufodontis (1940), non Nábělek (1923).

Herbs, annual, slender, procumbent to weak, 4–20 cm tall. Roots slender, reddish when dry. Stems slender, 4-angled, somewhat branched, sparsely retrorsely aculeolate to glabrous. Middle stem leaves opposite with clearly smaller, leaflike stipules in whorls of 4; blades drying papery, obovate or oblanceolate to linear-elliptic, (2–)3.5–10(–12) × 1–3.5(–5) mm, adaxially with sparse appressed hairs or glabrous, margins mostly antrorsely ciliate, otherwise glabrous, base acute, cuneate, or shortly petiolate, apex obtuse to acute but not mucronate; principal vein 1, with inconspicuous pinnate-reticulate lateral veins. Flowers mostly solitary; pedicels 1–3 mm, glabrous. Ovary subglobose, ca. 1 mm, densely covered with undeveloped trichomes. Corolla white, rotate, 1–1.5 mm in diam.; lobes 3(or 4), ovate, obtuse. Mericarps ovoid to elongated, 2–2.5 mm, with dense, white to yellowish brown, uncinat trichomes 0.2–0.5 mm, on pedicels elongating to 10 mm and curved near apex. Fl. Jun–Jul, fr. Aug–Sep.

Rock crevices on mountain slopes, sand and gravel drifts on grassy plains; 1200–4800 m. Gansu, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shanxi, Sichuan, Xinjiang, Xizang, Yunnan [India, Nepal].

In his description of *Galium handelii* Cufodontis (Oesterr. Bot. Z. 89: 234–235. 1940) referred to the close *G. songaricum* Schrenk (in Fischer & C. A. Meyer, Enum. Pl. Nov. 1: 57. 1841) but overlooked the older homonym by Nábělek and the Himalayan *G. exile*. This latter annual has a much wider distribution than thought before and is quite variable in China with respect to leaf shape and hairiness, length of pedicels, shape of mericarps, etc. In view of its remarkably small flowers and high fruit set, it very likely is autogamous.

Within the morphologically and DNA-analytically very isolated *Galium* sect. *Depauperata* (Ehrendorfer et al., Fl. Iranica 176: 231–232. 2005) *G. exile* is morphologically very close to the W North American *G. bifolium* S. Watson and particularly to *G. songaricum*, described from the C Asiatic mountain system of Alatau. This latter species, treated in FRPS as “*G. soongoricum*,” is assumed to differ by its 1- or 2(or 3)-flowered cymes, the 4-lobed flowers, and the strongly elongating fruiting pedicels. In FRPS (71(2): 224–227. 1999) both taxa are accepted and indicated for very much the same area in China. Nevertheless, a first analysis of all Chinese specimens in PE, KUN, MO, and WU has not revealed reliable differential characters. Even the inflorescence character and the corolla lobe number varies in some specimens. All these findings do not exclude the possibility that further and more detailed studies will allow to separate the populations from the mountains of C and N Asia as typical *G. songaricum*. But for the Chinese flora and the present treatment we recognize only one species, *G. exile*. In case that the two taxa cannot be separated as species in the future *G. songaricum* will have to replace *G. exile* for priority reasons.

As noted already by Cufodontis (loc. cit.), both *Galium exile* and *G. songaricum* have sometimes been misidentified as *G. pauciflorum*, a synonym of *G. spurium* from the *G. aparine* group. In contrast to *G.*

*exile*, the latter always has more than 4 leaf whorl elements, retrorsely aculeolate leaf margins, and more than 1-flowered cymes.

**17. *Galium formosense*** Ohwi, Repert. Spec. Nov. Regni Veg. 36: 55. 1934.

关山猪殃殃 guan shan zhu yang yang

*Galium kwanzanense* Ohwi.

Herbs, perennial, procumbent to erect, (5–)8–20(–30) cm tall. Stems 4-angled, sparsely to rather densely pilose, angles thickened. Leaves in whorls of 4, sessile; blade drying submembranous, blackish green, broadly elliptic to obovate, 4–20 × 3–10 mm, length/breadth index 2 or less, both surfaces sparsely to densely pilose at least along veins, base cuneate to obtuse, apex obtuse to rounded and mucronate; principal veins 3, palmate. Inflorescences with terminal and axillary, few- to many-flowered, 1–3 cm long cymes; peduncles sparsely pilose to glabrous and smooth; bracts spatulate to ovate, 1.5–3 mm; pedicels 1–4 mm. Flowers ?hermaphroditic. Ovary obovoid, ca. 0.5 mm, densely pubescent with uncinat trichomes. Corolla yellowish white, rotate, 1–2 mm in diam., glabrous; lobes 4, ovate, 0.4–0.8 mm, acute. Mericarps ovoid, ca. 1 mm, with dense white to yellowish uncinat trichomes 0.4–0.5 mm. Fl. Jun–Sep, fr. Jun–Nov.

• Mountains, along trails and roads, fields, open ditches; 600–3000 m. Taiwan (Gaoxiang).

Ohwi described the relatively tall (“20–30 cm”) *Galium formosense* from lower elevations and the condensed *G. kwanzanense* (“5–10 cm”) from an exposed higher peak of Taiwan. The technical differences indicated mainly relate to flower diameter (1 mm in the former, 2 mm in the latter). In their study of Taiwanese *Galium* Yang and Li (Bull. Natl. Mus. Nat. Sci., Taichung 11: 101–117. 1998; Fl. Taiwan, ed. 2, 4: 254–259. 1998) formally synonymized the taxa and demonstrate a considerable ecological amplitude of *G. formosense* s.l. Furthermore, the specific separation of *G. formosense* from two other Taiwan mountain endemics, with glabrous stems, *G. morii* and *G. tarokoense*, needs better documentation.

In FRPS (71(2): 243. 1999), W. C. Chen treated *Galium formosense* as a synonym of *G. elegans*. He referred to Cufodontis (Oesterr. Bot. Z. 89: 228. 1940) who supported the occurrence of *G. elegans* in Taiwan based on Hayata’s report of *G. rotundifolium* Linnaeus (in J. Coll. Sci. Tokyo 30(1): 148. 1911) and to J. M. Chao (in Fl. Taiwan 4: 261. 1978) who considered *G. elegans* to be the same as *G. formosense*. In their study of Taiwanese *Galium* Yang and Li (loc. cit. 1998; loc. cit. 1999) did not mention *G. elegans* nor compare *G. formosense* to it. This rather suggests that they were unaware of Cufodontis’s work than that they concluded the two species to be distinct. Similarly, Cufodontis (loc. cit.: 211–251), studying only mainland material, did not mention *G. formosense*, already described in 1934. The Taiwanese specimens at MO (studied by C. M. Taylor) appear to represent a distinct species but fall within *G. elegans* as more broadly circumscribed by Cufodontis (loc. cit.: 228–232). Thus, *G. formosense* is here provisionally separated and regarded as replacing *G. elegans* on Taiwan. In future studies, it will be of particular importance to clarify whether the dioecy or polygamodioecy found in *G. elegans* (see there) also occurs in *G. formosense*.

**18. *Galium forrestii*** Diels, Notes Roy. Bot. Gard. Edinburgh 5: 279. 1912.

丽江拉拉藤 li jiang la la teng

Herbs, perennial, 15–25 cm tall. Stems little branched, 4-

angled, ± retrorsely strigose hairy. Leaves in whorls of 4, sessile or shortly petiolate; blade rather subleathery, pale abaxially, ovate-elliptic, 8–12 × 3–5 mm, strigose to hirsute, abaxially yellowish brown glandular-punctate or striate, base cuneate, apex acute or apiculate; principal vein 1, 2 lateral veins weak. Inflorescences terminal, corymbiform, with terminal and axillary several-flowered and somewhat bracteate cymes; pedicels ca. 1.5 mm. Ovary obovoid, hispidulous. Flowers ca. 2.8 mm in diam., probably sexually differentiated (dioecious or polygamo-dioecious?). Corolla yellowish green, dark brown when dry, rotate, lobed for 3/4 or more; lobes 4, subovate, apiculate at apex. Fruit unknown, but probably with uncinete trichomes. Fl. Jun–Aug.

• Meadows on mountain slopes; 3000–3200 m. Sichuan (Yajiang), Yunnan (Lijiang).

Because of its uncertain fruit indumentum, *Galium forrestii* is in need of further studies. We have not seen authentic material but agree with Cufodontis (Oesterr. Bot. Z. 89: 232. 1940) that it is obviously close (or even identical?) with *G. glandulosum* and/or *G. hirtiflorum*. Their characteristic stem indumentum and other similarities link these taxa as members of the *G. hirtiflorum* group within *G. sect. Platygaliium* s.l. (see under *G. hirtiflorum*).

**19. *Galium ghilanicum*** Stapf, Denkschr. Kaiserl. Akad. Wiss., Wien. Math.-Naturwiss. Kl. 50: 53. 1886.

姬兰拉拉藤 ji lan la la teng

*Galium parisiense* Linnaeus var. *brachypodum* Boissier; *G. transcaucasicum* Stapf.

Herbs, annual, ascending, branching from base. Stems (4–)8–30(–40) cm tall, tender, 4-angled, with retrorsely aculeolate angles and numerous, rather short internodes. Leaves at middle stem region in whorls of (5 or)6–8(or 9), ± sessile; blade drying papery, linear-elliptic to narrowly oblanceolate, mostly glabrous but margins and sometimes abaxial vein sparsely to densely antrorsely aculeolate, base acute, apex acute-acuminate. Inflorescences narrowly thyrsoid, with axillary and terminal cymes mostly 2–6-flowered; peduncles as long or 2–4 × as long as subtending leaves, slightly divaricate, with 1 or 2 bracts, ± smooth; pedicels thin, 0.5–4 mm, reflexed and hardly elongated in fruit. Flowers hermaphroditic. Ovary obovoid to ellipsoid, ca. 0.8 mm, glabrous. Corolla white or greenish white, slightly cup-shaped, 0.8–1.2 mm in diam.; lobes ovate, acute to shortly apiculate. Mericarps subglobose to kidney-shaped, 0.8–1.5 mm, colliculate, glabrous.

Open habitats; ca. 700 m. Xinjiang (Yining) [Afghanistan, Nepal, N Pakistan, Tajikistan; SW Asia].

*Galium ghilanicum* belongs to the annual *G. sect. Microgalium* and is a taxon widespread in SW Asia. It is here recorded for the first time for China. In FRPS (71(2): 237. 1999) it was misidentified as *G. aparine* var. *leiospermum* (= *G. aparine* f. *leiocarpum*, *G. spurium*), from which it is clearly separable by its antrorsely (and not retrorsely) aculeolate leaf margins. The other Chinese representative of *G. sect. Microgalium*, *G. tenuissimum*, differs from *G. ghilanicum* mainly by its strongly elongated peduncles and pedicels.

**20. *Galium glandulosum*** Handel-Mazzetti, Symb. Sin. 7: 1028. 1936.

腺叶拉拉藤 xian ye la la teng

Herbs, perennial, caespitose, procumbent or erect, 5–15 cm tall. Stems numerous from reddish rhizomes and roots, usually strongly branched, 4-angled, densely retrorsely strigose hairy, hispidulous at nodes. Leaves in whorls of 4, sessile or subsessile; blade drying subleathery, quite variable in shape, ovate to oblong or lanceolate, (2.5–)4–10(–14) × (0.6–)1–3(–4.5) mm, sometimes with scattered hairs adaxially, on margins and on midrib abaxially, or mostly glabrescent, adaxially slightly shiny and papillose, abaxially matte and usually minutely glandular-punctate or -striate, base cuneate, margins revolute, apex acute or subobtuse; principal vein 1, lateral veins 2, weak. Inflorescences terminal and in axils of upper leaves, with few- to several-flowered and up to 2 cm long cymes; peduncles ± hairy, bracteate, ± divaricate in fruit; pedicels 1–2(–5) mm. Flowers usually sexually differentiated (dioecious or polygamo-dioecious?). Ovary obovoid, ca. 0.8 mm, with ± curved trichomes. Corolla yellowish, greenish, or ± brownish-reddish, rotate, 1.8–2.7 mm in diam.; lobes 4, ovate, obtuse or slightly acute. Mericarps reniform, 1.5–2 mm, mostly with ± uncinete trichomes of ca. 0.3 mm (very rarely also glabrous?), on straight or ± curved, up to 4 mm long pedicels. Fl. Jun–Aug, fr. Aug–Sep.

• Mountain slopes, river beaches, open shrublands and forests, grasslands, on rocks; 2300–3900 m. Sichuan, Xizang, Yunnan.

*Galium glandulosum* is mainly characterized by condensed habit, short and predominantly retrorse stem hairs, subleathery leaves, often with glandlike idioblasts on abaxial leaf sides, strongly bracteate cymes, sexual differentiation of flowers, and hooked trichomes on fruit. Glabrous-fruited specimens included by W. C. Chen in FRPS (71(2): 228. 1999) may belong to other species. *Galium glandulosum* and *G. forrestii* are members of the *G. hirtiflorum* group (see there) within *G. sect. Platygaliium* s.l.

**21. *Galium hirtiflorum*** Requier ex Candolle, Prodr. 4: 600. 1830.

毛花拉拉藤 mao hua la la teng

Herbs, perennial, weak, procumbent or suberect, 10–60 cm tall. Rhizome and roots red, filiform. Stems numerous, 4-angled, with retrorse and/or spreading hairs to glabrescent. Leaves and leaflike stipules in whorls of 4; blade drying papery or membranous, linear-elliptic to narrowly lanceolate, (3–)8–17(–25) × (0.5–)1–2.5(–3.5) mm, both surfaces hirsute or only midrib and margins with straight or slightly curved hairs, base gradually and shortly attenuate, apex obtuse to subacute or shortly acuminate; vein 1. Inflorescences terminal and axillary, with several- to many-flowered cymes on peduncles longer than leaves; pedicels 1–6 mm. Flowers evidently sexually differentiated (dioecious or polygamo-dioecious?). Ovary obovoid, ca. 0.5 mm, hairy. Corolla light greenish, marked with reddish, rotate, 2–2.5 mm in diam.; lobes 4, ovate, cuspidate, sparsely hirsute toward apex. Mericarps ellipsoid, 1–1.5 mm, with dense uncinete trichomes 0.5–0.7 mm. Fl. Jul–Aug, fr. Sep–Oct.

Among shrubs and stones; 1700–3000 m or higher. Expected in Xizang [Bhutan, India, Nepal].

*Galium hirtiflorum* was not included in the Chinese flora by W. C. Chen but is likely to occur in Xizang. According to Ehrendorfer et al.

(Fl. Iranica 176: 179. 2005) the group of *G. hirtiflorum* s.l. includes a series of vicarious Himalayan taxa: *G. subtrinervium* Ehrendorfer & Schönbeck-Temesy in Pakistan (Swat) and Kashmir, *G. hirtiflorum* s.s. extending eastward to Bhutan and possibly adjacent China, and finally *G. glandulosum* and *G. Forrestii* reaching Yunnan and Sichuan. Their common group characters are short and retrorse stem hairs, subleathery leaves with glandlike idioblasts abaxially, strongly bracteate cymes, sexual differentiation of flowers, and fruit with uncinatate trichomes.

**22. *Galium hoffmeisteri*** (Klotzsch) Ehrendorfer & Schönbeck-Temesy ex R. R. Mill, *Edinburgh J. Bot.* 53: 95. 1996.

六叶律 liu ye lü

*Asperula hoffmeisteri* Klotzsch, *Bot. Ergebn. Reise Waldemar*, 87. 1862; *Galium asperuloides* Edgeworth subsp. *hoffmeisteri* (Klotzsch) H. Hara; *G. asperuloides* var. *hoffmeisteri* (Klotzsch) Handel-Mazzetti; *G. asperulopsis* H. J. P. Winkler; *G. japonicum* Makino (1895), not (Maximowicz) Makino & Nakai (1908); *G. triflorum* Michaux var. *hoffmeisteri* (Klotzsch) J. D. Hooker.

Herbs, perennial, from filiform reddish rhizomes. Stems generally erect, (10–)15–30(–40) cm tall, 4-angled, glabrous and smooth, sometimes hispidulous at nodes. Middle stem leaves and leaflike stipules in whorls of up to 6 (in weak plants rarely only up to 4), with petioles up to 3 mm; blade drying papery or membranous, narrowly elliptic-oblong to broadly oblanceolate, (10–)15–30(–40) × (4–)5–10(–12) mm, length/breadth index mostly 2.5–3.5, glabrescent, smooth or rarely retrorsely aculeolate on abaxial midrib, base acute to obtuse, margins antrorsely aculeolate, apex obtuse to rounded and abruptly apiculate; vein 1. Inflorescences terminal and sometimes in axils of upper leaves, with few- to several-flowered cymes; peduncles glabrous, smooth; bracts none or few, 1–2 mm; pedicels 0.3–3 mm. Ovary obovoid to subglobose, 0.5–0.8 mm, strigillose with undeveloped trichomes. Corolla white or light green, rotate, 2.5–3 mm in diam., glabrescent, lobed for 3/4 or more; lobes 4, ovate, acute. Mericarps ellipsoid, 1.2–2 mm, with dense uncinatate trichomes 0.8–1.2 mm, on pedicels elongating and up to 10 mm. Fl. Apr–Aug, fr. May–Sep.

Forests on mountain slopes, thickets, along rivers, ditch sides, meadows; 400–4000 m. Anhui, Gansu, Guizhou, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Shaanxi, Shanxi, Sichuan, Xizang, Yunnan, Zhejiang [Afghanistan, Bhutan, India, ?Japan, Kashmir, Korea, Myanmar, Nepal, Pakistan].

*Galium hoffmeisteri*, together with *G. bungei*, *G. spurium*, and *G. verum*, is one of the most commonly collected species of *Galium* in China. Previous authors usually have included it as a subspecies under *G. asperuloides*. Only recently, the two taxa were discussed and re-established on the species level by Ehrendorfer et al. (Fl. Iranica 176: 183–185. 2005) and by Mill (loc. cit.). All specimens seen so far from China belong to *G. hoffmeisteri*. Nevertheless, as *G. asperuloides* s.s. ranges in the W Himalaya from Afghanistan to N Pakistan and N India, it can also be expected in SW China (in particular, Xizang). Accordingly, it is included in the present treatment for reference.

In Japan *Galium hoffmeisteri* is replaced by *G. nipponicum* Makino (*G. trifloriforme* var. *nipponicum* (Makino) Nakai), but some of the Japanese specimens greatly approach *G. hoffmeisteri*. Another very similar vicariant is *G. echinocarpon* from Taiwan. Further relatives are the Eurasian disjunct *G. odoratum* and the circumboreal *G. triflorum*.

Together with *G. asperuloides*, all these taxa belong to *G.* sect. *Hylaea* as shown by Ehrendorfer et al. (loc. cit.: 181–185). *Galium triflorum* is rare in China and closely related to *G. trifloriforme* (see under these species). The latter may be a hybridogenous taxon linking *G.* sect. *Hylaea* and *G.* sect. *Trachygalium*. But to synonymize *G. trifloriforme* with *G. hoffmeisteri* (e.g., W. C. Chen in FRPS 71(2): 230. 1999; Govaerts et al., *World Checkl. Rubiaceae*; <http://www.kew.org/wcsp/rubiaceae/>; accessed on 15 Sep 2010) is certainly not correct.

Slender plants of *Galium hoffmeisteri* are distantly reminiscent of *G. kikumugura* Ohwi (= *G. brachypodium* Maximowicz (1874), not Jordan (1846)) from Japan (see also under *G. sichuanense*). Yamazaki (Fl. Japan 3a: 236. 1993) described *G. kikumugura* as having leaf whorls of 4. In reality, it always develops whorls of up to 5 or 6 in the middle stem region. These leaves are quite similar to those of *G. hoffmeisteri* and have margins slightly antrorsely aculeolate or smooth. Nevertheless, *G. kikumugura* strongly deviates from *G. hoffmeisteri* and other members of *G.* sect. *Hylaea* by its cymes nearly exclusively lateral in leaf axils, usually consisting only of a filiform peduncle, a single bract, and 2 small flowers (ca. 1.5 mm in diam.) or sometimes a single flower. Furthermore, its kidney-shaped (not ellipsoid) mericarps (1.8–2 × 0.9–1 mm) differ by having scattered short and hooked hairs only ca. 0.1 mm. These latter characters are reminiscent of *G.* sect. *Trachygalium* and particularly of *G. bungei* (in *G.* sect. *Platygalium* s.l., where leaf whorls have only 4 elements). Thus, *G. kikumugura* is an isolated and aberrant species of the genus, possibly better placed into a separate monotypic section.

**23. *Galium humifusum*** M. Bieberstein, *Fl. Taur.-Caucas.* 1: 104. 1808.

蔓生拉拉藤 man sheng la la teng

*Asperula humifusa* (M. Bieberstein) Besser.

Herbs, perennial, sometimes slightly woody at base, clampering to procumbent, from a thick rootstock with slender, trailing reddish rhizomes. Stems up to 1 m tall, 4-angled to subterete, often caespitose, glabrescent to white pilosulous, hirtellous, and/or pilose often with mixed trichome types, smooth or sparsely scaberulous. Leaves in whorls of 6–10, sessile, frequently reflexed; blade drying papery, from linear and narrowly oblong-oblanceolate to oblong-elliptic or ligulate, (5–)10–28(–32) × (1–)1.5–3(–6) mm, adaxially glabrous and scaberulous, abaxially glabrous to densely white pilosulous or -pilose, base straight to cuneate, margin antrorsely aculeolate and usually markedly revolute, apex obtuse to acute and mucronate with tip to 2 mm; vein 1. Inflorescences with numerous terminal and axillary, congested to fasciculate, leaflike and many-flowered cymes; peduncles glabrous to hirtellous and/or pilosulous, with reduced leaves and leaflike bracts, 1.5–3 mm; pedicels 1–4 mm. Ovary ellipsoid, 0.8–1 mm, glabrous to hispidulous with straight trichomes. Corolla yellowish white to white, funnel-form, 1.5–2.5 × 2.5–3 mm, glabrous to sometimes hairy on outside; lobes 4, ca. 1/2 as long as tube, triangular-ovate, acute to apiculate. Mericarps ellipsoid to reniform, 1–1.5 × 1.5–2 mm, glabrous and smooth, granulate or hispidulous, becoming separated in middle as fruit expand but remaining attached at top and bottom. Fl. and fr. May–Oct.

Riversides and beaches, forests, grasslands, farmland sides, wastelands, meadows, mountain slopes; 400–2200 m. Xinjiang [Afghanistan, Kazakhstan, Mongolia, Pakistan, Russia, Turkistan; SW Asia (Armenia, Azerbaijan, Georgia, Iran, Iraq), E Europe (Balkan Peninsula, Ukraine)].

This species has often been included in *Asperula* (e.g., Pobedimova et al., Fl. URSS 23: 276. 1958) because of its funnelliform, relatively large, white corollas, but its affinities are clearly with members of *Galium*, particularly *G. verum*, though the flowers are distinct. Rarely the two species form a hybrid, which has been called *G. ×himmelbauerianum* (Ronniger) Soó, and both should be placed into *G. sect. Galium*.

*Galium humifusum* is “a widespread diploid species, very variable due to modificational plasticity and genetic diversity” (Ehrendorfer et al., Fl. Iranica 176: 197. 2005), but at present it does not appear possible to recognize infraspecific taxa.

**24. *Galium hupehense*** Pampanini, Nuovo Giorn. Bot. Ital. 17: 719. 1910.

湖北拉拉藤 hu bei la la teng

*Galium boreale* Linnaeus var. *molle* Hemsley; *G. hemsleyanum* Beauverd; *G. hupehense* var. *molle* (Hemsley) Cufodontis.

Herbs, perennial, erect, with slender rhizome. Stems 4-angled, pilosulous. Leaves in whorls of 4, subsessile; blade lanceolate, 30–50 × 6–12 mm, length/breadth index above 4, adaxially hispidulous to scaberulous, abaxially pilose at least on principal veins, apex acuminate to subacute; principal veins 3, palmate. Inflorescence terminal, paniculiform, 15–20 × 4–8 cm, with many-flowered cymes; peduncles and pedicels hairy to glabrescent. Ovary ovoid, densely hairy. Corolla yellowish white, rotate, ca. 2 mm in diam., glabrous or pilose; lobes 4, ovate, hairy outside, acute. Mericarps with straight trichomes (and/or ?glabrous). Fl. Jul, fr. Aug–Sep.

- Mountains; ca. 2000 m. Hubei (Yichang), Jiangsu (Kunshan).

*Galium hupehense*, possibly endemic to EC China, is evidently related to the also small-flowered *G. kinuta* (Cufodontis, Oesterr. Bot. Z. 89: 223–224. 1940) but has hairy stems, whereas *G. chekiangense* and *G. boreale* differ i.a. by their larger flowers (3–4 mm in diam.). As we have seen no authentic material of *G. hupehense*, the above description is based on available literature sources only. Its original description gives no information on ovary and fruit indumentum, whereas straight (and ?multicellular) hairs are indicated for the certainly synonymous *G. hemsleyanum*. Possibly by mistake, W. C. Chen (in FRPS 71(2): 281–282. 1999) reported plants with glabrous (var. *hupehense*) and with densely hairy ovaries (var. *molle*). Both are recorded from Yichang, only the latter from more condensed plants in Kunshan. These uncertainties and the status of *G. hupehense* with its varieties need to be clarified in the future.

**25. *Galium innocuum*** Miquel, Fl. Ned. Ind. 2: 341. 1857.

小猪殃殃 xiao zhu yang yang

*Galium modestum* Diels; *G. trifidum* Linnaeus var. *modestum* (Diels) Cufodontis.

Herbs, perennial, weak to procumbent, from slender rhizomes. Stems (7–)10–40(–60) cm, 4-angled, caespitose, glabrous and smooth to sparsely retrorsely aculeolate on angles. Leaves in whorls of 4(–6), subsessile; blade drying papery, blackish or green, linear-lanceolate to oblanceolate, 3–8(–10) × 1–2 mm, glabrous and smooth to sparsely retrorsely aculeolate on margins and midrib, base acute to attenuate, apex rounded or obtuse; vein 1. Inflorescences terminal and axillary, cymes 1–

3.5 cm, with 1–3(or 4) flowers; peduncles glabrous and smooth; bracts oblanceolate to narrowly elliptic; fruiting pedicels (3–)5–8(–10) mm, straight and ± divaricate. Ovary didymous, glabrous, smooth. Corolla white, cup-shaped to slightly campanulate, 1–1.8 mm in diam.; lobed to 1/2 or slightly more; lobes 3(or 4), ovate and rounded at tip. Fruit markedly didymous, mericarps (sub)globose, 2–2.8 mm, glabrous, smooth to slightly tuberculate. Fl. and fr. Mar–Aug.

Swampy or wet localities at lower to upper montane elevations. Fujian, Sichuan, Taiwan, Yunnan, and ?elsewhere [India, Indochina, Indonesia (Java, Sumatra), New Guinea].

In the available floras of China and Taiwan, W. C. Chen (in FRPS 71(2): 252–253. 1999) and Yang and Li (Bull. Natl. Mus. Nat. Sci., Taichung 11: 101–117. 1998; Fl. Taiwan, ed. 2, 4: 254–259. 1998) have completely ignored *Galium innocuum*, classifying most of the relevant specimens under *G. trifidum*. In the Kew Rubiaceae checklist (Govaerts et al., World Checkl. Rubiaceae; <http://www.kew.org/wcsp/rubiaceae/>; accessed on 15 Sep 2010) *G. trifidum* var. *modestum* appears as a synonym under *G. innocuum*, with a range from India to China and through Taiwan to SE Asia and New Guinea. Originally, *G. innocuum* was described from Java. In the critical revision of *G. sect. Aparinoides* by Puff (Canad. J. Bot. 54: 1911–1925. 1976), not considered by the above authors, *G. innocuum* is accepted as a valid species and regarded as a southern member of the *G. trifidum* group. The above diagnosis and distribution data correspond to Puff’s revision. He differentiated the two species mainly by their fruiting pedicels: relatively short, straight, and ± divaricate in *G. innocuum* but slender, elongated, and conspicuously arcuate in *G. trifidum* s.s. According to Puff (loc. cit.: 1922–1923) only *G. innocuum* but none of the subspecies of *G. trifidum* occur in China. This is in strong conflict with W. C. Chen (loc. cit.: 253) who described the distribution of *G. trifidum* in China by listing the provinces Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hebei, Heilongjiang, Hunan, Jiangsu, Jiangxi, Jilin, Liaoning, Nei Mongol, Shanxi, Sichuan, Taiwan, Xizang, Yunnan, and Zhejiang. As we have seen only limited Chinese material of *G. sect. Aparinoides*, the question remains whether *G. innocuum* extends from S to N China or is replaced further north by populations of the *G. trifidum* group not mentioned by Puff. Furthermore, one has to consider that species from other sections of *Galium* have often been misidentified as members of *G. sect. Aparinoides*, e.g., *G. bungei*. In view of these uncertainties, we accept only *G. innocuum* but not *G. trifidum* for the present Chinese flora.

Another problematic taxon in *Galium* sect. *Aparinoides* for the *Flora of China* is *G. palustre* Linnaeus. In spite of the critical comments by Cufodontis (Oesterr. Bot. Z. 89: 232. 1940), this species has been included in FRPS by W. C. Chen (loc. cit.: 250). According to Puff (loc. cit.: 1923–1924) this species belongs to the *G. palustre* group of taxa, with leaves often in whorls of more than 4, many-flowered cymes (more than 3 or 4 flowers), and smooth pedicels. Its natural distribution is verified from temperate and boreal Europe to W Siberia, whereas occurrences in E North America (and elsewhere) are obviously adventive. Considering the common confusion of *G. sect. Aparinoides* taxa (in China particularly *G. innocuum* in the south and *G. karakulense* in the north) and the lack of authentic specimens seen by us, we exclude *G. palustre* from China in the present text.

**26. *Galium kamschaticum*** Steller ex Schultes & J. H. Schultes, Mant. 3: 186. 1827.

三脉猪殃殃 san mai zhu yang yang

Herbs, perennial, erect, 5–25 cm tall, emerging from filiform rhizomes. Stems mostly unbranched, 4-angled, glabrous to sparsely hispidulous. Leaves in whorls of 4, sessile or subses-

sile; blade drying blackish brown and papery, broadly elliptic, ovate, or suborbicular, 10–25 × 6–17 mm, glabrous to hispidulous at least on veins, otherwise adaxially smooth, abaxially not glandular-striate, base cuneate to obtuse, margins antrorsely ciliolate or hispidulous, apex ± rounded and usually mucronate; principal veins 3, palmate. Inflorescences small, thyrsoid, cymes terminal and in axils of uppermost leaves, 2–6 cm, few to several flowered, lax; peduncles glabrous, smooth; bracts leaflike or ligulate to narrowly elliptic, 0.5–4 mm; pedicels 1–5 mm. Ovary subglobose, ca. 1 mm, densely pubescent with spreading uncinat trichomes. Corolla white or greenish yellow, rotate, 2.5–3(–4) mm in diam., glabrous, lobed for 3/4 or more; lobes 4, elliptic-lanceolate or ovate-triangular, acute. Mericarps ovoid, 1.5–2 mm, with dense uncinat trichomes 0.8–1 mm, on pedicels usually elongating to 15 mm. Fl. and fr. Jul–Sep.

Forests on mountains, tussocks at ditch sides; 1500–2300 m [as low as ca. 100 m in N Japan]. Heilongjiang, Jilin [Japan, Korea, NE Russia; NW North America].

*Galium kamschaticum* is an amphi-Beringian member of *G. sect. Platygali* and forms a related species group with *G. chekiangense* in SE China, *G. nakaii* in Japan, and *G. oreganum* in W North America. In the *Flora of Japan* (Yamazaki, Fl. Japan 3a: 206–240. 1993) three varieties are recognized, one of them endemic to Japan, the second extending to Sakhalin and the Kuriles, and only var. *kamschaticum* more widespread and extending to the NE provinces of China. Specimens from SE China, Zhejiang, that were determined as *G. kamschaticum* and those from Fujian that were listed by W. C. Chen (in FRPS 71(2): 265. 1999) as *G. nakaii* differ from typical *G. kamschaticum* by their leaves drying somewhat leathery, greenish-brownish, papillose, glandular-striate abaxially, and by their fruit with short hairs 0.1–0.2 mm, with a bent but not hooked tip. In the present flora they are treated as a new species, *G. chekiangense* (see the comments under that species).

**27. *Galium karakulense*** Pobedimova in Schischkin, Fl. URSS 23: 712. 1958.

粗沼拉拉藤 cu zhao la la teng

Herbs, perennial, weak to procumbent, 40–70 cm tall. Rootstock slender, with prolonged rhizomes. Stems 4-angled, flaccid, much branched, retrorsely aculeolate, hispidulous or glabrescent at nodes. Leaves in whorls of 4(or 5), subpetiolate; blade drying papery, elliptic to oblanceolate, (12–)15–20(–30) × (2–)5–8(–12) mm, densely antrorsely aculeolate adaxially and along margins, retrorsely aculeolate on abaxial midrib, base attenuate to cuneate, margins thinly revolute, apex rounded to bluntly pointed; vein 1. Inflorescences paniculate, terminal and lateral cymes with several to many flowers (usually more than 4); peduncles scabrous and ± divaricate; bracts ovate to elliptic, 3–7 × 1–3 mm; pedicels 2–4.5 mm, rough, elongated in fruit. Ovary didymous, glabrous. Corolla white, cup-shaped, 3–4(–4.5) mm in diam., 4-lobed to ca. 1/2. Mericarps (sub)globose, 1.5–2.5(–3.5) mm, glabrous, slightly verrucose. Fl. Jul, fr. Aug–Sep.

Swamps and riversides at low to middle elevations. Xinjiang (Chabuhaer) [Afghanistan, Kazakhstan, Kyrgyzstan, Russia, Tajikistan, Uzbekistan].

*Galium karakulense* represents *G. sect. Aparinoides* in C Asia and is considered as a link between the *G. trifidum* group in the N Hemisphere and the predominantly Mediterranean-European *G. palustre*

group (Puff, Canad. J. Bot. 54: 1923–1924. 1976). It is also treated in Pobedimova et al. (loc. cit.) and Ehrendorfer et al. (Fl. Iranica 176: 174. 2005) and may be responsible for some of the erroneous indications of *G. palustre* for N China, as discussed under *G. innocuum*. The latter is the second verified species of the section in the more southerly part of the Chinese flora. In comparison with *G. karakulense*, *G. innocuum* is a much smaller and more slender plant with few-flowered cymes and smooth pedicels.

**28. *Galium karataviense*** (Pavlov) Pobedimova, Novosti Sist. Vyssh. Rast. 7: 278. 1971.

喀喇套拉拉藤 ka la tao la la teng

*Asperula karataviensis* Pavlov, Vestn. Akad. Nauk Kazhsk. S.S.R. 4: 95. 1951; *A. aparine* M. Bieberstein, s.l.; *A. rivalis* Sibthorp & Smith, s.l.; *Galium rivale* (Sibthorp & Smith) Grisebach, s.l.

Herbs, perennial, procumbent and often matted or lodged, from slender, reddish brown rhizomes. Stems 0.6–1.2 m, much branched, densely retrorsely aculeolate on 4 angles. Leaves in whorls of 6–10, sessile or subsessile; blade drying papery or somewhat leathery and ± glossy, narrowly (ob)lanceolate or narrowly elliptic, (6–)15–25(–50) × (2–)2.5–4(–8) mm, glabrescent, both surfaces sparsely to densely aculeolate on midrib, base acute to cuneate, margins flat to narrowly revolute, densely retrorsely aculeolate, apex acute and shortly mucronate; vein 1. Inflorescences terminal and axillary, to 12 × 9 cm, with several to many-flowered cymes; peduncles elongating as inflorescences develop, becoming much longer than subtending leaves; axes glabrescent, sparsely to densely retrorsely aculeolate; bracts elliptic or oblong-lanceolate, 1.5–3 × 0.5–1 mm; pedicels 1–3 mm. Ovary ellipsoid to obovoid, 0.5–0.8 mm, glabrous. Corolla bluish to violet (rarely white?), shortly funnelliform, 1.5–2.5 mm, tube 1–1.5 × as long as lobes; lobes 4, triangular-spatulate. Mericarps subglobose to ellipsoid, 1.5–2 × 1.7–2 mm, glabrous, smooth or often tuberculate. Fl. and fr. Jun–Sep.

Humid forests, riversides, beaches, wet grasslands; 700–3300 m. Gansu, Hebei, Heilongjiang, Nei Mongol, Ningxia, Qinghai, Shanxi, Sichuan, Xinjiang [C Asia].

*Galium karataviense* was treated in FRPS (71(2): 280. 1999) as *G. rivale*. In a wider sense the latter name and its synonyms apply to a polymorphic polyploid complex (2x, 4x, 6x), ranging from NE, E, and SE Europe to SW and C Asia. Because of its funnelliform corollas this group formerly was treated as part of the genus *Asperula*, either as *A. aparine* or as *A. rivalis* (e.g., in Pobedimova et al., Fl. URSS 23: 275. 1958). More recently, morphological analyses (see Ehrendorfer et al., Fl. Iranica 176: 188. 2005) and DNA-data have clearly shown that it is closely related to *G. uliginosum* in *G. sect. Trachygalium*. Similarities with the annual *G. sect. Euaparine* are homoplasies.

In former treatments (e.g., Fl. Europaea 4: 20. 1976) *Galium rivale* was circumscribed in a wide sense. On the basis of differences in floral (relative length of corolla tube and lobes, color), fruit (mericarp epidermis with rounded or acute cells), and other characters, several still insufficiently understood microspecies have been suggested (Pobedimova et al., loc. cit.: 327, under *Asperula*; Ehrendorfer & Schönbeck, Pl. Syst. Evol. 174: 200–202. 1991, under *G. anguineum*; Ehrendorfer et al., loc. cit., under *G. pseudorivale* Tzvelev). Accordingly, among the vicarious microspecies of *G. rivale* s.l., *G. anguineum* Ehrendorfer & Schönbeck-Temesy from Iraq and Iran, with white corollas and divaricate fruiting axes, is replaced toward the east in C Asia by *G. karatavi-*

*iense*, with bluish to violet corollas and more convergent fruiting axes. Further studies will have to demonstrate whether species status is really justified for all these taxa and how they correspond to the different cytotypes encountered in this polyploid complex.

**29. *Galium kinuta*** Nakai & H. Hara, J. Jap. Bot. 9: 518. 1933.

显脉拉拉藤 xian mai la la teng

*Galium boreale* Linnaeus var. *japonicum* Maximowicz; *G. japonicum* (Maximowicz) Makino & Nakai (1908), not Makino (1895).

Herbs, perennial, erect, 20–60 cm tall. Stems with 4 thickened angles, glabrous and smooth, hispidulous only at nodes. Leaves in whorls of 4, subsessile or petiole to 2 mm; blade drying mostly somewhat leathery, remaining ± green, oblanceolate to ovate-lanceolate, sometimes even narrowly elliptic or ovate, 20–80 × 4–20 mm, length/breadth index (2–)3–5(–6), strigillose or hispidulous at least along veins to glabrescent, sparsely to densely punctate- to striate-glandular abaxially, base acute to rounded, margins flat to thinly revolute, antrorsely ciliolate to hispidulous, apex subacute to acute, but hardly concave and long acuminate; principal veins 3, palmate. Inflorescences paniculiform, to 25 × 15 cm, cymes in uppermost leaf axils and terminal, many flowered, lax and often somewhat divaricate; peduncles smooth and glabrous or hispidulous at nodes; bracts oblanceolate to narrowly elliptic, 1.5–3 mm; pedicels 1.5–3 mm. Ovary subglobose to obovoid, ca. 0.8 mm, smooth, glabrous. Corolla white to ± purplish, rotate, 2–2.5 mm in diam., glabrous; lobes 4, ovate, acuminate. Mericarps subglobose to obovoid, ca. 2.5 mm, glabrous and smooth. Fl. May–Jul, fr. Aug–Sep.

Mesic, generally rich forests on mountain slopes, rocks at watersides, open grasslands, meadows; 500–2100 m. Gansu, Hebei, Henan, Hubei, Liaoning, Shaanxi, Shanxi, Sichuan, Xinjiang [Japan, Korea].

*Galium kinuta*, described from Japan, was first reported for China by Cufodontis (Oesterr. Bot. Z. 89: 223–224. 1940). Nevertheless, the more numerous samples now available suggest certain differences: in Chinese specimens the leaves are more leathery (not paperlike) when dry, abaxially more markedly punctate-striate-glandular (not inconspicuously so), and apically ± acute (but hardly concave and long attenuate). It is still uncertain whether these differences merit taxonomic separation of the Japanese and Chinese populations. Another critical aspect is the occurrence of specimens intermediate between Chinese *G. kinuta* and local *G. boreale* s.l., as observed, e.g., from Henan, Shaanxi, and Shanxi. Local studies will have to show whether this is due to hybridization and whether it is linked to the extreme variability of *G. kinuta* in leaf shape, ranging from narrowly lanceolate to ovate.

*Galium kinuta* may be related to the still badly understood *G. hupehense* (see there). Similarities also exist with *G. platygalium*, which differs by funnelliform corollas. *Galium hoffmeisteri* (= *G. japonicum* Makino (1895)) and *G. kinuta* (= *G. japonicum* (Maximowicz) Makino & Nakai (1908)) have been widely confused because of similar habit and name confusion.

**30. *Galium kunmingense*** Ehrendorfer, Novon 20: 270. 2010.

昆明拉拉藤 kun ming la la teng

Herbs, perennial, erect, (12–)15–20(–25) cm tall. Stems with 4 prominent and rounded angles, with scattered antrorsely (or sometimes also retrorsely) curved short hairs, more dense at

nodes; internodes 1.5–4 cm at middle stem regions, longer or somewhat shorter than leaves. Leaves in whorls of 4; blade drying leathery, broadly lanceolate, (10–)15–25(–35) × (4.5–)6–7.5(–9) mm, length/breadth index (2–)2.5–3.5(–4), glabrous, adaxially papillose, abaxially without glandular idioblasts, base cuneate, margins revolute, antrorsely aculeolate, apex acute but not acuminate; 3 prominent principal veins extending into apex region. Inflorescences pyramidal, with cymes from middle to upper stem nodes and terminal, several to many flowered; axes glabrous, somewhat divaricate; peduncles mostly 1.5–4 cm; pedicels (0.5–)1–5 mm; bracts lanceolate, small and inconspicuous. Flowers hermaphroditic. Ovary obovoid, ca. 0.5 mm, glabrous, smooth. Corolla white to greenish, cup-shaped or campanulate, (2–)2.3–2.5(–2.7) mm in diam., fused at base for ± length of 4 free lobes, 0.8–1 mm, lanceolate, acute but not apiculate. Mericarps ovoid, 1.5–3 mm, glabrous and ± smooth. Fl. Jun–Aug, fr. Jul–Sep.

- Open grasslands and rocky slopes; 1900–2500 m. C Yunnan.

The new *Galium kunmingense* clearly belongs to *G.* sect. *Platygalium*. Among species in the section with corollas basally fused to ca. 1/2 the length *Microphysa elongata* deviates by leaves with only one main vein, somewhat inflated fruit mericarp, and funnelliform corollas. *Galium platygalium* and *G. maximoviczii* have similar corollas but deviate by their broader and 3–5-veined leaves. Closer relationships can be assumed for some E Asiatic *Galium* species with rotate corollas: *G. kinuta* has glabrous fruit but narrower, adaxially punctate-striate glandular leaves, slender, more floriferous inflorescences, and larger flowers. Apparent relatives with rotate and smaller flowers are *G. hupehense* with spreading straight fruit hairs, *G. chekiangense* with appressed curved fruit hairs, and particularly *G. yunnanense*, with spreading uncinately fruit hairs. This latter is ± sympatric with *G. kunmingense* but differs not only by its rotate (not campanulate/cup-shaped) and smaller corollas and uncinately fruit hairs, but also by its more hairy and abaxially punctate-striate glandular leaves. It is remarkable that *G. kunmingense*, a quite conspicuous species that evidently was not too rare in the surroundings of the capital of Yunnan, has remained unnoticed up to now.

**31. *Galium linearifolium*** Turczaninow, Bull. Soc. Imp. Naturalistes Moscou 7: 152. 1837.

线叶拉拉藤 xian ye la la teng

Herbs, perennial, erect, sometimes slightly woody at base. Stems up to 65 cm tall, 4-angled, hirtellous or puberulent to glabrescent or smooth and glabrous. Leaves in whorls of 4, sessile or subsessile; blade drying leathery, linear-spatulate, often slightly falcate, 10–60 × 1–4 mm, adaxially glabrous, weakly shiny, antrorsely aculeolate along midrib and/or near margins, abaxially glabrous or sparsely hirtellous along midrib, base cuneate or obtuse, margin antrorsely aculeolate or pubescent, revolute, apex obtuse to acute; vein 1. Inflorescences terminal, paniculiform, with few- to many-flowered, 1.5–5 cm long cymes; peduncles hirtellous to glabrous, smooth; bracts narrowly elliptic, 1–3 mm or often lacking; pedicels 1.5–6 mm. Ovary ellipsoid to obovoid, ca. 0.8 mm, glabrous, smooth. Corolla white, rotate, ca. 4 mm in diam.; lobes 4, lanceolate, acute. Mericarps ellipsoid to subglobose, 2.5–3 mm, glabrous and smooth. Fl. Jun–Aug, fr. Jul–Sep.

Grassy slopes, forests, thickets, mountain meadows; 400–1800 m. Hebei, Hubei, Liaoning [Korea].

*Galium linearifolium* seems to be a rare species and is easily confused with *G. boreale*. The latter has leaves usually somewhat lanceolate and with 3 main veins. Cufodontis (Oesterr. Bot. Z. 89: 219–223. 1940) mentioned a certain affinity of *G. linearifolium* with *G. bungei*. Although *G. linearifolium* is said in FRPS to have leaves in whorls of 4, the relevant figure (71(2): 251, t. 56, f. 3. 1999) shows them in whorls of 5, evidently a mistake.

**32. *Galium maximoviczii*** (Komarov) Pobedimova, Novosti Sist. Vyssh. Rast. 7: 277. 1971 [*“maximoviczii”*].

异叶轮草 yi ye lun cao

*Asperula maximoviczii* Komarov, Trudy Glavn. Bot. Sada 39: 109. 1923, based on *A. platygalium* Maximowicz var. *pratensis* Maximowicz, Bull. Acad. Imp. Sci. Saint-Petersbourg 19: 284. 1874.

Herbs, perennial, from thin creeping rhizomes. Stems erect, 0.3–1 m tall, 4-angled, smooth; nodes hispidulous or glabrous. Leaves in whorls of 4–6(–8), subsessile or with petiole up to 6 mm; blade drying papery, lanceolate-oblong, lanceolate-elliptic, or ovate to ovate-lanceolate, (23–)35–40(–53) × (7–)9–10(–18) mm, glabrous or sparsely to moderately hispidulous, at least on principal veins, margins antrorsely ciliolate or -aculeolate, base acute to cuneate, apex tapered and shortly obtuse to acute; veins 3–5, palmate. Inflorescences broadly paniculate, 4–20 × 2–15 cm, lax and many flowered, with cymes in axils of uppermost leaves and terminal; peduncles ± glabrous; bracts linear to narrowly elliptic, 1–5 mm; pedicels 2–4 mm. Ovary obovoid and laterally flattened, ca. 0.8 mm, glabrous, smooth. Corolla white, campanulate; tube ± as long as lobes, 2.5–3.5 mm in diam.; lobes 4, ovate-oblong, obtuse. Mericarps ellipsoid, 2–2.5 mm, glabrous, smooth to granular-papillose. Fl. Jun–Jul, fr. Jul–Oct.

Forests, thickets, or grasslands on mountains, open fields, ditch sides; 1600–3800 m. Anhui, Hebei, Heilongjiang, Henan, Jilin, Liaoning, Nei Mongol, Shaanxi, Shandong, Shanxi, Zhejiang [Korea, Russia].

*Galium maximoviczii* differs from the quite close *G. platygalium* (see there) by somewhat smaller campanulate flowers and larger leaves in whorls of up to 6(–8). Within *G. sect. Platygalium* the two species form an isolated group limited to the temperate E Asiatic mainland, characterized by its whorls of leaves and leaflike stipules often with more than 4, up to 6, or rarely even 8 elements, with 3–5 palmate principal veins, and campanulate to funnellform corollas. In Pobedimova et al. (Fl. URSS 23: 273. 1958) the two taxa were placed in the artificial *Asperula* sect. *Galioidae* Pobedimova ser. *Paniculatae* Pobedimova.

**33. *Galium megacyttarion*** R. R. Mill, Edinburgh J. Bot. 53: 200. 1996.

大胞拉拉藤 da bao la la teng

Herbs, perennial, weak to procumbent. Stems 6–40 cm, sharply 4-angled, glabrous, smooth, rough or sparsely retrorsely aculeolate; internodes 6.5–33 mm; nodes ± hairy. Middle stem leaves in whorls of up to 6, sessile; blade drying papery, often blackening, linear-oblong to narrowly elliptic, 2–12.5 × 0.4–2 mm, glabrous, smooth or sparsely retrorsely aculeolate on midrib abaxially, adaxially with relatively large epidermal cells (use 20× lens), base acute, margins flat to thinly revolute, apex acute then contracted and mucronate; vein 1. Inflorescences axillary, with 1- or occasionally 3-flowered cymes; pedicels

0.2–1.5 mm, glabrous, smooth. Ovary ellipsoid-obovoid, ca. 0.5 mm, glabrous, smooth. Corolla white or pale green (perhaps sometimes drying pink), rotate, 1.5–2.7 mm in diam.; lobes 4, lanceolate-spatulate, glabrous beneath, puberulent above, with shortly acuminate apex, clearly longer than stamens. Mericarps ellipsoid, 0.7–1.1 × 1–1.5 mm, glabrous, granular-verruculose, with pedicels often elongating to 3.5 mm. Fl. and fr. Jul–Sep.

Open places, forests; 1800–3100 m. ?Sichuan, Xizang [Bhutan, India, Nepal].

*Galium megacyttarion* (type from Uttar Pradesh, Raizada 7326, E) belongs to the high elevation Himalayan subgroup (2) of the *G. asperifolium* group, which includes *G. acutum* (see additional comments under these species). The protologue of *G. megacyttarion* describes the flowers as having stamens shorter than the corolla; comparable information is not yet available for the majority of the Chinese *Galium* species. We have seen no material cited in the original description nor plants which undoubtedly belong here. Nevertheless, one very condensed provenance (*Duthie 7492*, from Bhutan, the Black Mountain Expedition 1888, WU) exhibits the large leaf epidermal cells described for *G. megacyttarion*; but it deviates by having antrorse microhairs on the adaxial leaf side and glabrous leaf margins, finely rough stems, many-flowered cymes, and glabrous petals. It was determined by Cufodontis (Oesterr. Bot. Z. 89: 241–243. 1940) erroneously as *G. asperifolium* var. *sikkimense*. Another plant with large epidermal cells has been seen from Sichuan (W. C. Chen, 23 Jun 1988, PE), but this corresponds in all other characters to *G. pusillosetosum*.

**34. *Galium minutissimum*** T. Shimizu, J. Fac. Textile Sci. Technol. Shinsu Univ., A, 36(12): 58. 1963.

微小拉拉藤 wei xiao la la teng

Herbs, perennial (not annual), ascending, caespitose, minute, 2–3 cm tall. Stems 4-angled, branched, glabrous or sometimes hispidulous at nodes. Leaves in whorls of 4; blade rhombic-oblong, 2–3 × 0.8–1 mm, glabrous or abaxially hispidulous along midrib, base attenuate, apex obtuse; vein 1. Inflorescence with terminal and partly axillary few-flowered cymes, glabrous axes, and ca. 2 mm long pedicels. Flowers unknown. Mericarps reniform, sparsely hispid with apically weakly curved trichomes.

- Mountains; 1800–2400 m. Taiwan (Hualian).

*Galium minutissimum* was accepted as a species by W. C. Chen (in FRPS 71(2): 283. 1999) but was not treated or mentioned by Yang and Li in their publication on *Galium* in Taiwan (Bull. Natl. Mus. Nat. Sci., Taichung 11: 101–117. 1998) or in the subsequent second edition of Fl. Taiwan (4: 254–259. 1998). We have seen no authentic material, and the specific status of *G. minutissimum* remains uncertain. The taxon obviously belongs to *G. sect. Platygalium* and the closely related *G. morii* group (see there) from the high mountains of Taiwan.

**35. *Galium morii*** Hayata, Icon. Pl. Formosan. 7: 32. 1918.

森氏猪殃殃 sen shi zhu yang yang

*Galium sigeyosii* Masamune.

Herbs, perennial, erect, 5–10 cm tall. Stems slender, 4-angled, glabrous. Leaves in whorls of 4, sessile or subsessile; blade drying papery, obovate, ovate, elliptic, or elliptic-oblong, 1–6 × 1.5–10 mm, glabrous or sparsely hairy abaxially, base obtuse, margins smooth, apex obtuse or apiculate-acute; principal veins 3, palmate. Inflorescences terminal or sometimes axil-

lary, with few-flowered cymes of 0.5–1.5 cm; peduncles and bracts glabrous; pedicels 1–2 mm. Ovary densely strigillose with undeveloped trichomes. Corolla ?white, rotate, ca. 1.2 mm in diam., lobed for 3/4 or more; lobes 4, ovate. Mericarps subglobose, ca. 1 mm, with dense, ± appressed uncinat trichomes.

- Mountains; 2500–3400 m. Taiwan (Jiayi).

*Galium morii* was described as a very small plant from Yu Shan (Mt. Morrison) in Taiwan. We have seen no authentic material. The present description combines information from the protologue, FRPS (71(2): 241. 1999), and Yang and Li (Bull. Natl. Mus. Nat. Sci., Taichung 11: 106–107. 1998; Fl. Taiwan, ed. 2, 4: 256. 1998). But there are certain conflicts: whereas the leaves were characterized by FRPS as 1- or indistinctly 3-veined, the protologue and Yang and Li said they were 3-veined.

*Galium morii* was the first species to be described from an obviously closely related assembly of *G. sect. Platygalium* taxa growing in the high mountains of Taiwan, which is here called the *G. morii* group and also includes *G. formosense*, *G. minutissimum*, *G. nankotaizanum*, and *G. tarokoense*. On the mainland, the newly described *G. rupifragum* from Yunnan obviously also belongs here. This *G. morii* group is characterized by low and condensed growth, small ovate to elliptic or broadly lanceolate leaves, reduced inflorescences, and hairy fruit. Affinities obviously exist with the aggregates of *G. elegans* and *G. serpylloides*.

Characters used to differentiate the taxa of the *Galium morii* group are stem indumentum, number of leaf veins (1–3), uncinat to straight fruit hairs, etc., but many taxonomical problems remain. As an example: *G. morii* may not be clearly separable from *G. tarokoense* by its smaller and sparsely pubescent, 3-nerved leaves (vs. larger, completely glabrous, and rather 1-nerved leaves of *G. tarokoense*); the two taxa are geographically separated according to Yang and Li (loc. cit. 1998: 107, 110). Furthermore, relationships between the alpine core group (as *G. morii*) and other taxa with taller growth from lower elevations (as *G. formosense*) evidently need more attention in the future. Transitional states in the above characters make it necessary to place several species in two or three different positions in our key.

**36. *Galium nankotaizanum*** Ohwi, Repert. Spec. Nov. Regni Veg. 36: 56. 1934.

南湖大山猪殃殃 nan hu da shan zhu yang yang

*Galium maborasense* Masamune.

Herbs, perennial, erect, often reduced, 5–12(–20) cm tall. Stems 4-angled, sparsely to moderately pilose becoming glabrescent, angles thickened. Leaves in whorls of 4, sessile to subsessile; blade drying membranous, ovate, elliptic, or broadly lanceolate, 4–10 × 2–5 mm, length/breadth index 2–3, both surfaces sparsely hirsute at least along midrib, base cuneate to obtuse, apex acute to obtuse, sometimes apiculate; principal vein 1, 2 lateral veins weakly developed. Inflorescences terminal and in upper leaf axils, with cymes 2- to several flowered, 2–16 mm, shorter to somewhat longer than subtending leaves; peduncles glabrescent, bracteate; pedicels 0.8–4 mm. Flowers hermaphroditic. Ovary obovoid, ca. 0.5 mm, densely appressed hairy. Corolla white, rotate, 2–2.5 mm in diam., lobed for 1/2–2/3; lobes 4, ovate. Fruit on pedicels becoming deflexed to nodding; mericarps obloid to oblate, 0.8–1 mm, densely grayish yellow hairy with straight or slightly curved trichomes ca. 0.8 mm. Fl. Jul, fr. Aug–Sep.

- Under shrubs and in rock crevices; 3000–3500 m. Taiwan (Hualian, Nantou, Yilan).

*Galium nankotaizanum* is closely related to a group of species described from the high mountains of Taiwan (see under *G. morii*). *Galium maborasense*, treated as a separate but dubious species by W. C. Chen (in FRPS 71(2): 284. 1999), was explicitly synonymized by Yang and Li (Bull. Natl. Mus. Nat. Sci., Taichung 11: 107. 1998) with *G. nankotaizanum*. This publication apparently was not available to Chen, but here we follow these Taiwanese authors.

*Galium nankotaizanum* is mainly characterized by its straight or slightly curved fruit trichomes. This links it to the high-alpine Himalayan group of *G. serpylloides* s.l. (see there). Otherwise, *G. nankotaizanum* also appears similar to taxa with hooked fruit trichomes, e.g., *G. tarokoense*, with glabrous stems and only 1 principal leaf vein, from which it apparently differs by larger flowers.

**37. *Galium odoratum*** (Linnaeus) Scopoli, Fl. Carniol., ed. 2, 1: 105. 1771.

车轴草 che zhou cao

*Asperula odorata* Linnaeus, Sp. Pl. 1: 103. 1753.

Herbs, perennial, from slender and elongated rhizomes. Stems erect, 10–50 cm tall, 4-angled, glabrous and smooth except hispidulous at nodes. Leaves in whorls of 6–10, sessile or petiole to 1 mm; blade drying papery, oblanceolate, oblong-lanceolate, or narrowly elliptic, (6–)15–50(–65) × (3–)4.5–15(–17) mm, length/breadth index ca. 4, glabrous except antrorsely aculeolate on margins and with antrorse microhairs on upper side and sometimes on abaxial midrib, base acute to cuneate, margins flat, apex acute or usually obtuse then abruptly mucronate; vein 1. Inflorescences terminal, with several- to many-flowered cymes; axes glabrous, smooth; bracts none or leaflike, 1–3 mm; pedicels 1–4 mm. Ovary ellipsoid to obovoid, ca. 0.8 mm, densely hispidulous. Corolla white or bluish white, ± broadly funnellform, 4.5–6.5 × 3–7 mm, glabrous, lobed for ca. 1/2; lobes 4, triangular-spatulate, acute. Mericarps subglobose, 2–2.5 mm, with dense uncinat trichomes 1–1.2 mm. Fl. and fr. Jun–Sep.

Mountain forests; 1500–2800 m. Gansu, Heilongjiang, Jilin, Liaoning, Ningxia, Qinghai, Shandong, Shanxi, Sichuan, Xinjiang [Japan, Korea, Russia; NW Africa, SW Asia, Europe; introduced in North America].

Dried plants of *Galium odoratum* have a sweet coumarine odor, which is still evident on herbarium specimens; its name refers to this. On account of its funnellform corollas (with the tube ± as long as the lobes), *G. odoratum* usually has been treated as a member of *Asperula*. As shown by Ehrendorfer et al. (Fl. Iranica 176: 183. 2005) and verified by DNA-analytical studies, it belongs to *G. sect. Hylaea* and is closely related to *G. asperuloides* and *G. hoffmeisteri*. Without flowers it is difficult to separate, particularly from the former with more narrow leaves, but generally *G. odoratum* is more robust. As a constant element of temperate deciduous forests (often with *Fagus*), it has an extensive but rather disjunct distribution area throughout Eurasia, with diploid cytotypes in E Asia, replaced by tetraploids in Europe.

**38. *Galium paniculatum*** (Bunge) Pobedimova, Novosti Sist. Vyssh. Rast. 7: 277. 1971.

圆锥拉拉藤 yuan zhui la la teng

*Asperula paniculata* Bunge in Ledebour, Fl. Altaic. 1: 140. 1829; *Galium xinjiangense* W. C. Chen.

Herbs, perennial, often somewhat caespitose from elongated, much branched, and ca. 1 mm thick rhizomes. Stems erect, to 60 cm tall, 4-angled, little branched, glabrous and smooth, only sometimes puberulent at nodes. Leaves in whorls of up to 6, subsessile; blade drying papery, discolorous (more pale abaxially), lanceolate or narrowly lanceolate, (15–)25–60(–70) × (3–)5–10(–12) mm, glabrous, smooth or mostly somewhat antorsely ciliolate on margins and midrib, base acute to cuneate, apex acute to acuminate; vein 1. Inflorescences terminal, 8–16 × 8–16 cm, corymbiform to paniculate, lax, with several- to many-flowered cymes; axes glabrous, smooth with few lanceolate, 1–3 mm long bracts and 1.5–6 mm long pedicels. Ovary obovoid, ca. 1 mm, glabrous. Corolla white, drying often yellowish brown, campanulate to funnel-form, ca. 4 mm in diam., glabrous, lobed for ca. 1/2; lobes 4, triangular, acute. Fruit on elongating pedicels with ellipsoid, ca. 2 mm, glabrous and smooth mericarps. Fl. Jun–Jul, fr. Aug–Sep.

Montane river valleys, open forests, grasslands, rocky slopes and talus; 1300–1900 m. Xinjiang [Russia].

When W. C. Chen described *Galium xinjiangense*, he compared it only with the completely different *G. odoratum*, not being aware of the certainly conspecific *G. paniculatum*. Because of its corolla shape, this characteristic and relatively isolated taxon was originally described as *Asperula*. But there is no affinity to any group of *Asperula* as presently circumscribed. Instead, there are similarities with *G. ser. Nemoralia* M. Popova of *G. sect. Leiogalium* and with some members of *G. sect. Orientalium*. Therefore, the transfer of *A. paniculata* to *Galium* by Pobedimova was fully justified.

Pobedimova et al. (Fl. URSS 23: 271. 1958) also discussed the disjunct distribution of this relict species, which extends from its center in the Altai to the middle Yenisei and to the Dzungarian Alatau in NW China (Xinjiang).

**39. *Galium paradoxum*** Maximowicz, Bull. Acad. Imp. Sci. Saint-Petersbourg 19: 281. 1874.

林猪殃殃 lin zhu yang yang

Herbs, perennial, ascending from filiform rhizomes. Stems erect, slender, 4–25 cm tall, 4-angled and narrowly winged, glabrous and smooth, only nodes slightly shortly hairy. Middle stem leaves opposite and with 2 leaflike but clearly smaller stipules in whorls of 4, at lower nodes stipules linear, 1.5–3 mm; petiole 1.5–10 mm; leaf blade membranous, suborbicular, broadly ovate to ovate-lanceolate, or elliptic-oblong, (5–)6–30(–40) × (3.5–)5–15(–23) mm, adaxially with scattered, ± appressed, short hairs, abaxially glabrescent, base attenuate, obtuse to truncate, margins antorsely hispidulous-ciliolate, apex acute to rounded; single principal vein with 2–4 pairs of pinnate lateral veins. Inflorescences terminal and in axils of upper leaves with 3–11-flowered cymes; axes trichotomous and ± divaricate; bracts narrowly elliptic or ligulate, 0.8–3 mm; pedicels 1–3 mm. Ovary ovoid, ca. 0.5 mm, with undeveloped uncinat hairs. Corolla white, rotate, 2.5–3 mm in diam., lobed for 1/2–2/3; lobes ovate, obtuse, subapiculate to acute or acuminate. Mericarps ovoid, 1–2 mm, densely covered with uncinat yellowish brown trichomes 0.8–1 mm, on pedicels thickening and elongating up to 11 mm. Fl. May–Aug, fr. Jun–Sep.

Forests, meadows, near water, on shady (sub)alpine rocks; 1200–

4000 m. Anhui, Gansu, Guangxi, Guizhou, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jilin, Liaoning, Qinghai, Shanxi, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [Bhutan, India, Japan, Korea, Nepal, Russia].

*Galium paradoxum* is a rather unusual species of the genus because of its broad, petiolate, and pinnately nerved opposite leaves, forming whorls of 4 with 2 smaller leaflike stipules. Therefore, it can be confused with other genera, in particular *Kelloggia*, which differs by its calyx teeth and its never-leaflike stipules. Because of its isolated position, *G. paradoxum* was made the type species of *G. sect. Cymogalia* and placed into a monotypic series, *G. ser. Paradoxa* (see Pobedimova et al., Fl. URSS 23: 326. 1958). As shown by Ehrendorfer et al. (Fl. Iranica 176: 232. 2005) and unpublished DNA analyses, it is only distantly related to *G. kamschaticum*, *G. rotundifolium*, and *G. elegans* in *G. sect. Platygaleum* s.l. or to members of *G. sect. Hylaea*, as *G. hoffmeisteri*.

Schönbeck-Temesy and Ehrendorfer (in Tan et al., Davis & Hedge Festschrift, 111–114. 1989) commented on the morphological variation and biogeography of *Galium paradoxum* and recognized three subspecies, of which subsp. *paradoxum* and subsp. *duthiei* occur in China as keyed out and described below. The third, *G. paradoxum* subsp. *franchetianum* Ehrendorfer & Schönbeck-Temesy, is restricted to Japan and can be recognized by its relatively larger leaves with relatively short trichomes and often acute apices, and by its relatively large flowers. A survey of many new collections now available from the herbaria PE, KUN, MO, and WU shows that ranges of variation in all differential features used overlap and that many intermediates occur. With respect to the two Chinese taxa one can suspect not only an allopatric but also an altitudinal differentiation pattern.

- 1a. Leaves usually lanceolate-ovate, (10–)12–30(–40) × (5–)7–15(–23) mm; corolla lobes obtuse to subapiculate ..... 39a. subsp. *paradoxum*
- 1b. Leaves broadly ovate to suborbicular, (5–)6–10(–17) × (3.5–)4–7(–10) mm; corolla lobes acute to acuminate ..... 39b. subsp. *duthiei*

**39a. *Galium paradoxum* subsp. *paradoxum***

林猪殃殃(原亚种) lin zhu yang yang (yuan ya zhong)

Leaves ovate-lanceolate or sometimes ovate or elliptic-oblong, attenuate at base, (10–)12–30(–40) × (5–)7–15(–23) mm. Corolla lobes obtuse to subapiculate. Fl. May–Aug, fr. Jun–Sep.

Forests, meadows, near water; 1200–3000 m. Anhui, Gansu, Guangxi, Guizhou, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jilin, Liaoning, Qinghai, Shanxi, Sichuan, Yunnan, Zhejiang [Bhutan, Korea, Russia].

**39b. *Galium paradoxum* subsp. *duthiei*** Ehrendorfer & Schönbeck-Temesy in Tan et al., Davis & Hedge Festschrift, 113. 1989.

达氏林猪殃殃 da shi lin zhu yang yang

Leaves broadly ovate to suborbicular, (5–)6–10(–17) × (3.5–)4–7(–10) mm, truncate at base. Corolla lobes acute to acuminate. Fl. Jul–Aug, fr. Jul–Sep.

On shady (sub)alpine rocks; 2700–4000 m. Hubei, Sichuan, Xizang, Yunnan [Bhutan, India, Nepal].

In an otherwise quite typical specimen of this subspecies (e.g., Sichuan, Lutinghsien Mujaogou: T. P. Wang 18-9-1938, PE) the stipules at the mid-stem region are quite comparable to true leaves, only

slightly smaller. This results in a considerable similarity to small plants of *Galium hoffmeisteri* from *G. sect. Hylaea*, which differ by their leaves and leaflike stipules in whorls of up to 5 or 6.

**40. *Galium platygalium*** (Maximowicz) Pobedimova, Novosti Sist. Vyssh. Rast. 7: 277. 1971.

卵叶轮草 luan ye lun cao

*Asperula platygalium* Maximowicz, Bull. Acad. Imp. Sci. Saint-Petersbourg 19: 284. 1874.

Herbs, perennial, from thin creeping rhizomes. Stems erect, 20–35 cm tall, with 4 thickened angles, smooth, at nodes glabrous or hispidulous. Leaves in whorls of 4(–6), subsessile, with petiole up to 2 mm; blade drying papery to leathery, elliptic or elliptic-oblong to ovate, (12–)20–25(–28) × (7–)10–11(–15) mm, glabrous or hirtellous to hispidulous along principal veins, ± abruptly narrowed into short petiole, margins antrorsely ciliate, apex obtuse to subacute; principal veins 3–5, palmate. Inflorescences umbel-like thyrsoid and many-flowered panicles with terminal and lateral cymes from uppermost leaf axils; peduncles smooth and glabrous; bracts narrowly oblanceolate or elliptic to ligulate, 1–3 × 0.5–1.5 mm; pedicels 0.5–1.5 mm. Ovary ellipsoid, ca. 0.8 mm, glabrous. Corolla white, funnellform, with tube ± as long as lobes, 4–5 mm in diam.; lobes 4, elliptic-oblong. Mericarps ovoid, 1.7–2.8 mm, glabrous and smooth. Fl. and fr. Jul–Sep.

Open forests on mountain slopes; ca. 1700 m. Heilongjiang, Jilin, Shanxi [Korea, Russia].

*Galium platygalium* is closely related to *G. maximoviczii* (see there) but has larger flowers and whorls of opposite leaves and leaflike stipules with 4 or more (rarely up to 6) elements. Because of their slightly elongated, fused corolla base, the two species in the older literature were placed into the genus *Asperula*, where they had no other close relatives. In spite of their increase in leaf whorl elements, the two species have been placed by Ehrendorfer et al. (Fl. Iranica 176: 175. 2005) into *G. sect. Platygalium* s.l. Though this section normally is characterized by leaf whorls with only up to 4 elements, this placement may be justified because the two species correspond otherwise quite well, as in habit, inflorescences, and leaves (with 3–5 palmate principal veins).

Furthermore, *Galium platygalium* and *G. maximoviczii* exhibit similarities with *Microphysa elongata* (see p. 216), also with a well-developed corolla tube but with leaves in whorls of only 4 and only 1 main vein. Thus, the monotypic “genus” *Microphysa*, maintained here, is another obvious member of *G. sect. Platygalium*.

**41. *Galium prattii*** Cufodontis, Oesterr. Bot. Z. 89: 244. 1940.

康定拉拉藤 kang ding la la teng

Herbs, perennial, erect to weak, up to 50 cm tall. Stems obtusely 4-angled, usually branched, ± retrorsely aculeolate on angles or glabrous. Leaves in whorls of 6, sessile; blade drying papery, lanceolate, 15–35 × 2.5–6 mm, glabrous, adaxially smooth or scaberulous along midrib and near margins, abaxially sparsely retrorsely aculeolate along midrib, base cuneate, margins sparsely to densely retrorsely aculeolate, flat to thinly revolute, gradually narrowed into acute to acuminate apex; vein 1. Inflorescences terminal and axillary, cymes many flowered; peduncles glabrous, smooth; bracts none or few, 1–2 mm; pedicels 1–4 mm. Ovary obovoid, 0.5–0.8 mm, glabrous. Corolla

white to greenish, rotate, 2.5–3 mm in diam., lobed for 2/3 or more, glabrous; lobes 4, triangular-spatulate, acute to shortly acuminate. Mericarps ovoid, ca. 1 mm, glabrous, smooth or minutely granulose. Fl. Jun, fr. Aug.

• Valleys, open habitats of the montane zone; 3100–3700 m. Sichuan (Kangding).

*Galium prattii* apparently is endemic in Sichuan. It is often so close to forms of the reddish-purplish flowering *G. blinii* that only the longer lanceolate leaves, the more flower-rich cymes, and the white to greenish flower color of *G. prattii* help to separate them. Otherwise, *G. prattii* seems to link *G. asperifolium* and *G. tokyoense*. From the first it differs by less-bracteate inflorescences and less-acuminate corolla lobes, from the second by its leaves, which are lanceolate and apically more gradually narrowed (vs. subspatulate and apically rounded, mucronate).

**42. *Galium pusillosetosum*** H. Hara, J. Jap. Bot. 51: 134. 1976.

细毛拉拉藤 xi mao la la teng

Herbs, perennial, procumbent and ascending, caespitose, (5–)10–20(–40) cm tall. Stems with 4 prominent whitish angles, variable from ± densely hispid with straight trichomes of ca. 0.8 mm to retrorsely (very rarely also antrorsely) aculeolate. Middle stem leaves in whorls of up to 5 or 6 (never only 4), subsessile; blade drying blackish, narrowly oblanceolate to narrowly lanceolate, (3–)5–10(–17) × 0.8–2(–4.2) mm, hispid, retrorsely aculeolate on midrib and margins or glabrescent, base cuneate, apex acute and shortly mucronate; vein 1, whitish. Inflorescences with axillary and/or terminal cymes, few to several flowered; peduncles divaricate, with leaflike bracts, 1–3 mm; pedicels 0.5–3 mm. Ovary ovoid, ca. 0.6 mm, densely hispidulous, glabrescent or glabrous. Corolla purple, yellowish green, or white, rotate, 2.5–3 mm in diam., glabrous or scaberulous inside; lobes 4, ovate, acute. Fruit subglobose, ca. 2 mm in diam., with dense to sparse ± uncinat trichomes 0.5–0.7 mm or glabrous and smooth. Fl. and fr. May–Aug.

Mountain slopes, open ground and grasslands; 2100–3900 m. Gansu, Nei Mongol, Ningxia, Qinghai, Shanxi, Sichuan, Xinjiang, Xizang [Bhutan, Nepal].

*Galium pusillosetosum* is an obvious alpine member of the *G. asperifolium* group (*G. sect. Trachygalium* s.l.). Main differential characters are its relatively dense leaf and stem indumentum and its conspicuous whitish stem angles. These separate it from *G. acutum*, *G. baldensisforme*, *G. megacyttarion*, *G. rebae*, *G. glabriusculum*, and *G. sungpanense*. Nevertheless, its variability with respect to leaf epidermal cell size, flower color, and ovary and fruit indumentum is remarkable.

**43. *Galium rebae*** R. R. Mill, Edinburgh J. Bot. 53: 195. 1996.

芮芭拉拉藤 rui ba la la teng

?*Galium bodinieri* H. Léveillé.

Herbs, perennial, procumbent and mat-forming. Stems (5–)14–30(–45) cm, 4-angled or -sulcate, branched, glabrous and smooth, but sometimes with scattered straight hairs. Leaves in whorls of up to 6, sessile; blade drying papery, blackish, linear-lanceolate to narrowly oblanceolate, 2.5–10.5 × 0.4–1.4 mm, with inconspicuous epidermal cells, glabrous and smooth, rarely with a few straight hairs on abaxial midvein, base cuneate, margins entire and smooth, flat to thinly revolute, apex acute, contracted and shortly mucronate; vein 1. Inflorescences

with predominantly axillary cymes, 1–6-flowered; axes glabrous, smooth; pedicels 0.1–3.2 mm. Ovary ellipsoid-obovoid, ca. 0.5 mm, glabrous, smooth. Corolla red, purple, or occasionally white, rotate, 1.7–3.6 mm in diam., glabrous to papillose; lobes 4, lanceolate-spatulate, adaxially glabrous except puberulent on margins and central vein, apex acute to shortly acuminate. Mericarps ellipsoid, ca.  $1.5 \times 0.7$  mm, glabrous and smooth or granular-verruculose, on pedicels often elongating to 5 mm. Fl. and fr. Jun–Nov.

Damp banks under evergreen forests, alpine meadows, on rocks; 2000–4000 m. Sichuan, Xizang, Yunnan [Bhutan, India (Sikkim), Nepal].

*Galium rebae* belongs to the Himalayan and SW Chinese complex of (sub)alpine taxa from the *G. asperifolium* group studied by Mill (Edinburgh J. Bot. 53: 193–213. 1996; Fl. Bhutan 2(2): 825–834. 1999). It is closely related to *G. acutum* and often only separable by its flower color (see comments under that species). At the same time, it appears linked to the likewise reddish flowering but larger *G. blinii* at lower elevations. Reddish flowers also occur in *G. pusillosetosum*, which differs by its dense stem, leaf, and fruit indumentum.

#### 44. *Galium rupifragum* Ehrendorfer, Novon 20: 273. 2010.

屏边拉拉藤 ping bian la la teng

Herbs, perennial, densely caespitose, emerging from a slender branching rootstock; all vegetative parts very fragile when dried and with a loose indumentum of soft hairs, 0.5–0.8 mm,  $\pm$  straight and spreading, on upper leaf surface slightly retrorse. Stems ascending or erect, 5–10 cm tall, 4-angled, hairy, with 12–18 internodes, increasing in length from 2–8(–15) mm upward, with some short vegetative lateral branches from middle region to inflorescence base. Leaves in whorls of 4; blade thinly papery and remaining  $\pm$  greenish when dried, ovate to broadly lanceolate, 5–8  $\times$  2.5–3.5 mm, loosely hairy on both sides and marginally, base attenuate, margins flat or slightly revolute, apex acute to apiculate; principal veins 3, palmate, lateral weak. Inflorescences terminal, often with 3 cymes, each with 3–5 flowers; bracts few and  $\pm$  reduced; peduncles 4–5 mm and pedicels 0.5–3 mm, glabrescent, somewhat elongated and divaricate in fruit. Flowers hermaphroditic. Ovary ovoid, ca.  $0.5 \times 0.3$  mm, with still undeveloped appressed hairs. Corolla greenish white, rotate, ca. 1.5 mm in diam., with 4 triangular and acute to slightly apiculate lobes. Mericarps 0.8–1 mm, with spreading uncinat trichomes ca. 0.25 mm. Fl. and fr. Jul–Sep.

- Mountain regions, on rocks; ca. 1800 m. Yunnan (Pingbian).

The above description of *Galium rupifragum* is based on two sheets collected by H. T. Tsai (*H. T. Tsai 60986*) on rocks at the type locality and deposited in PE. *Galium rupifragum* belongs to *G.* sect. *Platygalium* s.l. and exhibits affinities with the *G. bungei* group, in particular with *G. salwinense*. Both share slender growth and uncinat fruit hairs. But *G. salwinense* has fewer (only up to 10) and longer (up to 10–20 mm) stem internodes, smaller leaves, only 1 (and not 3) main leaf veins, and smaller flowers. Nevertheless, on Emei Shan (Sichuan) typical *G. salwinense* occurs at lower elevations, whereas at higher elevations reduced forms approach *G. rupifragum*. In addition, there are also obvious similarities between *G. rupifragum* and representatives of the *G. morii* group (see there), growing with five accepted species in the high mountains of Taiwan, particularly with *G. morii* itself and with the related *G. formosense*. Main differences from the latter are its lower growth and smaller leaves, from the former its hirsute stems and the more divaricate, often longer peduncles and pedicels.

#### 45. *Galium salwinense* Handel-Mazzetti, Symb. Sin. 7: 1028. 1936.

怒江拉拉藤 nu jiang la la teng

Herbs, perennial, weak, procumbent to ascending, from filiform rhizome, 8–50 cm tall. Stems 4-angled, glabrous or with sparse spreading hairs. Middle stem leaves in whorls of 4, sessile or subsessile; blade drying papery, dark green, narrowly ovate or elliptic to oblong-lanceolate, (3–)5–18(–23)  $\times$  (1.5–)3–7(–11) mm, sparsely and at margins antrorsely hairy, base attenuate, apex slightly acute; vein 1. Inflorescences terminal and axillary, slender and slightly divaricate, cymes 1.5–6 cm, rather few flowered; axes glabrous, nearly ebracteate; pedicels (2–)4–8(–12) mm. Ovary obovoid, ca. 1 mm, appressed hairy. Corolla yellowish,  $\pm$  rotate, 1–1.3 mm in diam.; lobes 4, triangular,  $\pm$  obtuse. Mericarps ovoid, 1–1.5 mm, densely with short uncinat trichomes ca. 0.1 mm. Fl. and fr. Jul–Oct.

- Shady habitats, rocks in forests; 1700–2800 m. Sichuan, Yunnan (Gongshan).

The regional *Galium salwinense* is apparently closely related to the widespread *G. bungei*. Nevertheless, its habit, elongated pedicels, and fruit surface, always with short and spreading hooked trichomes, offer reliable differential characters.

#### 46. *Galium saurense* Litvinov, Trudy Bot. Muz. Imp. Akad. Nauk 7: 75. 1910.

狭序拉拉藤 xia xu la la teng

*Galium densiflorum* Ledebour var. *saurense* (Litvinov) Tzvelev.

Herbs, perennial, caespitose, with stout rootstock and slender, woody rhizomes. Stems erect or ascending, 8–30 cm tall, 4-angled and  $\pm$  puberulent. Leaves in whorls of 4 in lower and of 6 in middle stem region, sessile; blade dark green adaxially, pale green abaxially, linear or linear-oblong, 7–15  $\times$  0.5–2.5 mm, smooth or usually sparsely to densely scaberulous adaxially, usually densely hairy abaxially, base acute to cuneate, margins  $\pm$  revolute, apex mucronate; vein 1. Inflorescences narrowly paniculate with axillary and terminal, 3–15-flowered cymes; peduncles bracteose,  $\pm$  densely pubescent (rarely glabrescent), with 1–3 mm long pedicels. Ovary ellipsoid,  $\pm$  puberulent. Corolla yellow, rotate, 3–4 mm in diam., lobed for 3/4 or more; lobes 4, ovate-oblong, acute. Mericarps ellipsoid, ca. 2  $\times$  3 mm,  $\pm$  densely puberulent (rarely glabrous or  $\pm$  tuberculate). Fl. and fr. Jul–Aug.

Alpine and subalpine habitats. Qinghai, Xinjiang [Kazakhstan, Kyrgyzstan, Mongolia, Russia].

*Galium saurense*, a C Asiatic mountain taxon, belongs to *G.* sect. *Galium* and the extremely polymorphic Eurasian *G. verum* group. It refers to condensed alpine populations, in which the leaf whorls are reduced to 4–6 elements. The Kew Rubiaceae checklist (Govaerts et al., World Checkl. Rubiaceae; <http://www.kew.org/wcsp/rubiaceae/>; accessed on 15 Sep 2010) treats it as a synonym of *G. verum* subsp. *verum*, whereas Ehrendorfer et al. (Fl. Iranica 176: 199, 204. 2005) suggest to maintain its specific rank as long as the whole group has not been studied more intensively. In Pobedimova et al. (Fl. URSS 23: 368–369. 1958) *G. saurense* is reported i.a. from the Tien Shan in the border region of Kazakhstan and Xinjiang, but its description is in conflict with

plate 21, figure 1, which rather corresponds to *G. majmechense* and *G. consanguineum*. W. C. Chen (in FRPS 71(2): 285. 1999) included *G. saurense* as a dubious species and suspected its occurrence in NW China. We have seen no authentic specimens, but vouchers from Xinjiang and Qinghai (and possibly other provinces) fit its description quite well. Nevertheless, their separation from *G. verum* s.s. is partly doubtful.

**47. *Galium serpylloides*** Royle ex J. D. Hooker, Fl. Brit. India 3: 207. 1881, s.l.

隆子拉拉藤 long zi la la teng

Herbs, perennial, ascending, 3–10 cm tall. Rootstock woody, rhizomatous. Stems 4-angled, branched, shortly pubescent. Leaves in whorls of 4 (or ?5), sessile; blade drying papery, ovate or elliptic, 4–6 × 2.5–4 mm, glabrous or sparsely hirtellous, base rounded, margins thinly revolute, usually with antrorse microhairs, apex obtuse or slightly acute; principal vein 1 (or with 2 inconspicuous side veins). Inflorescences terminal and in axils of upper leaves, with cymes 5–8 mm, few or usually 3-flowered; pedicels 1–2 mm. Flowers hermaphroditic to subdioecious. Ovary appressed hairy. Corolla yellowish green, rotate, ca. 2 mm in diam.; lobes 4, ovate-triangular, acute. Mericarps up to 2 mm, with straight lanate hairs. Fl. and fr. Jun–Sep.

Mountain slopes; 3600–3800 m. Xizang (Lhünzê) [India, Nepal].

Originally, *Galium serpylloides* was very broadly circumscribed as a species widely distributed throughout the whole Himalayan range. But a critical taxonomic analysis of the group by Schönbeck-Temesy and Ehrendorfer (Pl. Syst. Evol. 155: 77–87. 1987) revealed five vicarious and geographically well-separated species from Kashmir in the west to Nepal in the east: *G. gymnopetalum* Ehrendorfer & Schönbeck-Temesy, *G. lakulense* Ehrendorfer & Schönbeck-Temesy, *G. serpylloides* s.s., *G. saipalense* Ehrendorfer & Schönbeck-Temesy, and *G. nepalense* Ehrendorfer & Schönbeck-Temesy. The above cited locality from E Xizang, Lhünzê, published in FRPS (71(2): 228. 1999), is much further to the east, i.e., SE of Lhasa and NE of Bhutan. We have neither seen authentic material from this nor from other Xizang and Charme province collections in the herbarium BM (e.g., Ludlow, Sheriff & Taylor 6390). At the moment, it is not possible to decide whether they correspond to one of the above mentioned species of the *G. serpylloides* group, or the related *G. glandulosum* group, or represent a still undescribed taxon. Therefore, we provisionally classify these SE Xizang populations under *G. serpylloides* s.l.

Characteristic morphological features of the *Galium serpylloides* group are the whorls of 4 leaves and leaflike stipules, the trend toward palmate leaf veins and sexual differentiation of flowers, and the change from hooked to straight fruit hairs. All this suggests relationships with members of *G. sect. Platygali* s.l., as the *G. morii* group (in particular *G. nankotaizanum*) or the *G. elegans* group. These trends reappear (probably as a homoplasy?) in the W North and South American *G. sect. Lophogali* K. Schumann, evidently derived from ancestors similar to *G. sect. Platygali* s.l.

**48. *Galium sichuanense*** Ehrendorfer, Novon 20: 275. 2010.

四川拉拉藤 si chuan la la teng

Herbs, perennial, from filiform rhizomes ascending to erect, ca. 30 cm tall. Stems single, strongly branched from base, with 4 prominent and whitish angles, glabrous and smooth, only slightly aculeolate at nodes. Middle stem leaves and leaf-like stipules in whorls of 4–6; blade drying papery and greenish-brownish, lanceolate, (12–)15–20(–25) × (3–)4–6(–7) mm, glabrous but on adaxial side near margins with antrorse appressed microhairs, on ± flat margins retrorsely (sometimes

also somewhat antrorsely) aculeolate, subsessile and gradually narrowed into base, largest breadth near middle, apex cuspidate with hyaline point; principal vein 1. Inflorescences broadly ovate, many flowered, cymes terminal and lateral, 2.5–5 cm, slender, leafy and bracteate to last branches, ± divaricate; axes glabrous; peduncles 1.5–2 cm; pedicels 0.5–5 mm. Flowers hermaphroditic. Ovary obovoid, 0.5–0.8 mm, with appressed curved hairs. Corolla dried reddish brown, rotate, 1.5–2 mm in diam.; lobes 4, triangular, cuspidate. Mericarps ovoid, 1.8–2.5 mm, with ± spreading uncinatate trichomes 0.2–0.3 mm. Fl. Jul–Aug, fr. Aug–Sep.

• Mountain forests; 3200–4000 m. Sichuan (Daocheng).

Up to now, only two collections of *Galium sichuanense* are known from the type locality. The new species is morphologically isolated and not closely related to any other taxon of the genus. Its character profile, particularly its perennial, hemicryptophytic growth form, the partly retrorsely aculeolate leaf margins, and the fruit with uncinatate trichomes, designates it as a member of *G. sect. Trachygalium*, but there are also features reminiscent of *G. sect. Hylaea* (cf. Ehrendorfer et al., Fl. Iranica 176: 181. 2005). Nevertheless, the combination of the branching pattern, the membranous leaves, the predominant glabrescence, the leafy inflorescences, and the small flowers separate it clearly from all other members of the two sections.

Another isolated and apparently relict species from E Asia has to be compared with *Galium sichuanense*, the Japanese *G. kikumugura* (see also under *G. hoffmeisteri*). The two share the leaves in whorls of 4–6, the small flowers, and the hooked fruit trichomes. In contrast, the habit and the somewhat antrorsely rough or even aculeolate leaf margins of *G. kikumugura* are reminiscent of *G. bungei* (*G. sect. Platygali*). Unique characters of *G. kikumugura* are the very few-flowered cymes on long peduncles with a single bract and the elongate, curved mericarps. Its taxonomic placement within *Galium* also is uncertain.

**49. *Galium glabriusculum*** Ehrendorfer, nom. nov.

无梗拉拉藤 wu geng la la teng

Replaced synonym: *Galium smithii* Cufodontis, Oesterr. Bot. Z. 89: 236. 1940, not *Galium smithii* G. Don, Gen. Hist. 3: 660. 1834 [*Sherardia erecta* Smith, Fl. Graec. 2: 14. 1813].

Herbs, perennial, weakly procumbent to erect. Stems (5–)7–15(–30) cm, 4-angled, glabrous and smooth, rarely shortly hairy at nodes. Leaves in whorls of up to 5 or 6, subsessile; blade greenish brown and subleathery when dried, narrowly lanceolate to narrowly elliptic, 3–12 × 1–2.5 mm, glabrous and smooth, very rarely with straight hairs adaxially or slightly retrorsely aculeolate on margins, base cuneate, margins thinly revolute, apex acute and shortly mucronate; vein 1. Inflorescences with terminal and lateral 1–3-flowered cymes on up to 10 mm long peduncles (often elongating in fruit) and with subsessile flowers on 0.5–3 mm long pedicels. Ovary subglobose, ca. 1 mm, densely covered with undeveloped trichomes. Corolla white, rotate, ca. 1.5 mm in diam.; lobes 4, ovate, obtuse. Mericarps ellipsoid, ca. 3 mm, with dense spreading yellowish brown uncinatate trichomes ca. 0.7 mm. Fl. and fr. Jul–Aug.

• Meadows, alpine mountain slopes; 3800–4700 m. Gansu, Qinghai, Sichuan, Xinjiang.

*Galium glabriusculum* is a well-documented species of the alpine subgroup (2) within the *G. asperifolium* complex (see under that species and *G. acutum*). It is similar to *G. sungpanense* and *G. baldensiforme*

and mainly differs from the former by its narrower and more leathery leaves and from both by the nearly total lack of indumentum.

**50. *Galium spurium* Linnaeus, Sp. Pl. 1: 106. 1753.**

猪殃殃 zhu yang yang

*Galium agreste* Wallroth; *G. agreste* var. *echinospermum* Wallroth; *G. agreste* var. *leiospermum* Wallroth; *G. aparine* Linnaeus var. *echinospermum* (Wallroth) T. Durand; *G. aparine* f. *leiocarpum* Makino; *G. aparine* var. *leiospermum* (Wallroth) T. Durand; *G. aparine* var. *spurium* (Linnaeus) W. D. J. Koch; *G. aparine* var. *tenerum* (Grenier & Godron) H. G. Reichenbach; *G. aparine* var. *vallantii* (Candolle) W. D. J. Koch; *G. hongnoense* H. Léveillé; *G. oliganthum* Nakai & Kitagawa; *G. pauciflorum* Bunge (1833), not Willdenow ex Candolle (1830); *G. spurium* var. *echinospermum* (Wallroth) Hayek; *G. spurium* var. *tenerum* Grenier & Godron; *G. vallantii* Candolle; *G. wutaicum* Hurusawa.

Herbs, annual, procumbent or climbing, 30–50 cm tall. Stems 4-angled, 0.5–2.5 mm in diam., ± branched from base, retrorsely aculeate on angles, glabrescent to pilose at nodes. Leaves at middle stem region in whorls of 6–8, subsessile; blade drying papery, narrowly oblanceolate to narrowly oblong-oblanceolate, 5–40 × 1–5(–8) mm, usually pilosulous or hispidulous adaxially, retrorsely aculeolate along midrib abaxially and along margins, base acute, margins flat to thinly revolute, apex acute and shortly mucronate; vein 1. Inflorescences terminal and axillary, cymes 2- to several flowered; axes glabrous to aculeolate; bracts leaflike or none, 1–5 mm; peduncles 1–4 cm; pedicels 0.5–1.5 mm, finally elongating and often curved directly under fruit. Ovary subglobose, 0.3–0.5 mm, with uncinete trichomes or glabrous. Corolla yellowish green or white, rotate, 1–1.5 mm in diam., lobed for 2/3 or more; lobes 4, triangular to ovate, acute. Mericarps subglobose to broadly kidney-shaped, 1–3 mm in diam., glabrous or often densely covered with uncinete trichomes 0.1–1 mm from straight bases. Fl. Mar–Jul, fr. Apr–Nov.

Open fields, riversides, farmlands, mountain slopes; near sea level to 4600 m. Common and widespread throughout China except Hainan and Nanhai Zhudao [Africa, Eurasia, and the Mediterranean; today sporadically adventive worldwide].

This species is occasionally used medicinally.

*Galium spurium* consists of basal elements ( $2x$  and  $4x$ ,  $2n = 20$ ,  $40$ ) of a polymorphic polyploid complex, the *G. aparine* group or *G. aparine* s.l. (see there). Following Ehrendorfer et al. (Fl. Iranica 176: 234. 2005), *G. spurium* is maintained here at the species level, with particular reference to its differential characters in flower and fruit size, and not included under the higher polyploid and aneuploid *G. aparine* s.s., as in Cufodontis (Oesterr. Bot. Z. 89: 245–247. 1940) and W. C. Chen (in FRPS 71(2): 237. 1999). *Galium spurium* is very common and widespread in China, in contrast to the rare and partly doubtful *G. aparine* s.s. To our knowledge, no chromosome counts are yet available from Chinese populations of *G. spurium*. Nevertheless, a report of  $2n = 40$  for this species from Novosibirsk (Krasnikov & Schaulo, Bot. Žurn. 75: 118–120. 1990) suggests the occurrence of  $4x$  *G. spurium* cytotypes in Asia, corresponding to similar  $4x$ -cytotypes reported from Africa.

From the varieties recognized by Cufodontis (loc. cit.) and accepted by W. C. Chen (loc. cit.: 234–237) *Galium spurium* var. *tenerum* refers to reduced specimens, which can appear under extreme conditions as modifications everywhere, and are taxonomically irrele-

vant. But as genetically fixed reduced alpine ecotypes they deserve a name: *G. spurium* subsp. *ibicinum* (Boissier & Haussknecht) Ehrendorfer, described from high mountains in SW Asia (see Ehrendorfer et al., loc. cit.: 236). Some condensed alpine Chinese specimens may belong to this taxon.

In contrast, *Galium spurium* var. *echinospermum* vs. var. *spurium* (= *G. aparine* var. *leiospermum*) refer to genetically fixed forms with uncinete hairy vs. glabrous fruit, which in W Eurasia and the Mediterranean often occur together in the same population and can be separated as taxonomic forms. In China we have seen only the *echinospermum* type, whereas var. *spurium* apparently is missing there. The reference to it by W. C. Chen (loc. cit.: 237) concerns the glabrous fruited *G. ghilanicum* (see there). It is obvious that a more detailed analysis of the *G. aparine*-*G. spurium* polyploid complex in E Asia is badly needed.

The enormous variability of *Galium aparine* and *G. spurium* has caused its many synonyms and common misidentifications with other annual and even perennial taxa of *Galium*. This applies in particular to the annual *G. tricormutum*, which differs by strongly verrucose (but not uncinete hairy) fruit, and to the perennial taxa with retrorsely aculeolate stems and fruit with uncinete hairs, such as *G. sungpanense* (see there), *G. dahuricum*, etc., which often have larger flowers.

**51. *Galium sungpanense* Cufodontis, Oesterr. Bot. Z. 89: 238. 1940.**

松潘拉拉藤 song pan la la teng

Herbs, perennial, slender, with tender rootstock. Stems procumbent or ascending, up to 30 cm, 4-angled, ± retrorsely aculeolate to somewhat hispidulous or smooth. Leaves in whorls of up to 5 or 6, sessile or narrowed to very short petiole; blade drying greenish brown and stiffly papery to subleathery, oblanceolate or narrowly elliptic-oblanceolate, 3.5–12(–15) × 1.5–3.5 mm, glabrous to ± hispidulous, sparsely to densely retrorsely aculeolate along margins and sometimes also on abaxial side of midrib, margins thinly revolute, apex acute and cuspidate; vein 1. Inflorescences with terminal and axillary cymes, 1–3-flowered with lanceolate bracts; peduncles up to 10 mm, glabrous and smooth; pedicels 2–7 mm, straight and elongating in fruit. Ovary obovoid, 0.5–0.8 mm, densely covered by undeveloped uncinete trichomes. Corolla pinkish or ± purplish, rotate, 1.1–1.5 mm in diam., glabrous; lobes 4, triangular, obtuse. Fruit with obovoid mericarps, ca. 2.5 mm, densely covered with spreading yellowish brown uncinete trichomes 0.4–0.8 mm. Fl. and fr. Jul–Sep.

• Thickets or meadows, often in shady places; higher elevations up to 3300 m. Hebei, Sichuan, Xinjiang.

The description of *Galium sungpanense* in FRPS (71(2): 233. 1999) includes some details that do not agree with the material seen and may have been based in part on specimens of other taxa. This has been corrected in the above description.

*Galium sungpanense* belongs to the throughout-perennial *G. sect. Trachygalium* s.l. and the *G. asperifolium* group (see there). It appears to link its montane (1) and alpine (2) subgroups and shares the few-flowered cymes with the latter. From *G. baldensiforme* and *G. glabriusculum*, both also with uncinete fruit hairs, it is separated by marginally stronger retrorsely aculeolate and partly longer leaves.

Remarkable are the close affinities between *Galium sungpanense* and members of the annual *G. sect. Euaparine*. The single decisive difference is the tender perennial (and possibly short-lived?) rootstock of *G. sungpanense*. Only its pinkish to purplish flowers and the never-curved fruiting pedicels allow the separation of plants collected without

subterranean organs from the common *G. spurium*. This suggests that *G. sect. Euparine* could have originated from *G. sect. Trachygalium*-like ancestors.

**52. *Galium taiwanense*** Masamune, Trans. Nat. Hist. Soc. Formosa 29: 180. 1939.

台湾猪殃殃 tai wan zhu yang yang

Herbs, perennial, procumbent. Stems 4-angled, sparsely scaberulous. Leaves on main stems in whorls of up to 6, sessile; blade drying papery, oblanceolate or narrowly obovate-oblong, (4-)10-20(-31) × (1-)2-4 mm, glabrous and smooth adaxially, glabrous or hairy and retrorsely aculeolate along midrib abaxially and along margins, base acute to cuneate, apex acute or acuminate; vein 1. Inflorescences with terminal and axillary, few- to several-flowered, usually regularly trichotomous cymes; bracts linear, ca. 2 mm; pedicels slender, 3-5 mm. Ovary ovoid, ca. 0.7 mm, glabrous. Corolla white, rotate, 2-2.5 mm in diam., lobed for 2/3 or more; lobes 4, ovate, obtuse. Mericarps ellipsoid, ca. 2 mm, glabrous. Fl. May-Jul, fr. Jul.

- Mountain slopes; 200-2100 m. N Taiwan.

We have seen no material from this taxon. Judging from the information and the holotype photograph presented by Yang and Li (Bull. Natl. Mus. Nat. Sci., Taichung 11: 109, pl. 4, 3+4. 1998), this appears to be close to and possibly even identical with *Galium dahuricum* var. *dahuricum*.

**53. *Galium takasagomontanum*** Masamune, Trans. Nat. Hist. Soc. Formosa 26: 52. 1936.

山地拉拉藤 shan di la la teng

Herbs, perennial (not annual), erect, ca. 30 cm tall. Stems 4-angled, slender, much branched, glabrous. Leaves in whorls of 4 or 5, sessile; blade narrowly ovate or ovate, abaxially pilose along veins, apex acuminate; principal vein 1 or with 2 short and weakly developed lateral veins. Inflorescences terminal, with few-flowered trichotomous cymes; peduncles glabrous; pedicels 1-2 mm, glabrous. Ovary ovoid-subglobose, ca. 1 mm, with undeveloped trichomes. Corolla white, rotate, ca. 3 mm in diam.; lobes 4, acute. Mericarps subglobose, with dense uncinat trichomes. Fl. and fr. Jul.

- Conifer mountain forests; ca. 2800 m. Taiwan.

*Galium takasagomontanum* was not treated or mentioned by Yang and Li (Bull. Natl. Mus. Nat. Sci., Taichung 11: 101-117. 1998; Fl. Taiwan, ed. 2, 4: 254-259. 1998), and we have not seen authentic material. According to the protologue it may belong to the condensed Taiwan mountain group of *G. morii* (see there), where it appears similar with its weakly 3-nerved leaves to *G. nankotaizanum* but differs by glabrous stems, somewhat larger flowers, and uncinat trichomes on mericarps. Nevertheless, its quite tall growth, the partly 5-whorled leaves, the exclusively terminal inflorescences, and the flower size are more indicative of its being a synonym of the Taiwanese *G. echinocarpum* from *G. sect. Hylaea*. A definite placement will only be possible after inspection of the type material.

**54. *Galium tarokoense*** Hayata, Icon. Pl. Formosan. 7: 33. 1918.

太鲁阁猪殃殃 tai lu ge zhu yang yang

Herbs, perennial, procumbent to erect, condensed, 5-8 cm

tall. Stems 4-angled, glabrous, smooth. Leaves in whorls of 4, sessile or subsessile; blade drying papery, rhombic-elliptic, elliptic, or obovate, 3-6 × 2-3.5 mm, glabrous, base acute to cuneate, margins flat or thinly revolute, apex acute to somewhat obtuse; vein 1. Inflorescences with terminal and axillary cymes, 1- or few flowered, 0.3-1.5 cm; peduncles glabrous, smooth, ebracteate; pedicels 0-2 mm. Ovary obovoid, ca. 0.4 mm, densely strigillose at sides. Corolla pale yellow, rotate, ca. 2 mm in diam.; lobes 4, triangular-oblong, acute. Mericarps ellipsoid, 1-1.5(-2) mm, with dense, appressed uncinat trichomes ca. 0.3 mm. Fl. and fr. summer-winter.

- Shady sites on limestone substrates; 1400-2700 m. Taiwan.

*Galium tarokoense* belongs to a group of high mountain taxa from Taiwan, including *G. morii* (see there). Its main differential characters are the lack of indumentum on most parts, the only 1-nerved leaves, and the short appressed fruit hairs.

**55. *Galium tenuissimum*** M. Bieberstein, Fl. Taur.-Caucas. 1: 104. 1808.

纤细拉拉藤 xian xi la la teng

Herbs, annual, erect. Stems (10-)30-50(-60) cm tall, with strong, intricate and divaricate branching from base, 4-angled, usually retrorsely aculeolate, more rarely glabrescent to smooth. Leaves at middle stem region in whorls of 6-8, subsessile or sessile; blade drying papery, linear to oblanceolate, (4-)8-15(-20) × 0.5-1(-2) mm, mostly glabrous and sparsely to densely antrorsely aculeolate near margins and on veins abaxially, base straight to acute, apex acute to acuminate-aristate; vein 1. Inflorescences broadly paniculate, very lax and loosely divaricate, cymes axillary and terminal, with 3-11(-14) flowers; axes glabrous or sparsely hispidulous; bracts none or small, leaflike; pedicels 3-15 mm, strongly elongating in fruit up to 20 mm. Ovary obovoid to ellipsoid, ca. 0.8 mm, glabrous. Corolla whitish, pale yellow, or greenish, rotate to slightly cup-shaped, 1.5-2 mm in diam., glabrous; lobes 4, oblong-elliptic, acute to aristate. Mericarps ellipsoid to obovoid, ca. 1 × 1.25 mm, glabrous, smooth or ± tuberculate. Fl. and fr. May-Jul.

Open mountain slopes; 300-2800 m. Xinjiang (Xinyuan) [Kashmir, Kyrgyzstan, Pakistan, Russia, Turkmenistan; SW Asia (Armenia, Georgia, Iran, Iraq, Lebanon, Syria, Turkey), Europe (Balkan Peninsula, Hungary)].

*Galium tenuissimum* is a member of the annual *G. sect. Microgalium*, differentiated by antrorsely aculeolate leaf margins. It is widespread through SE Europe, SW and C Asia, and reaches its eastern limit in NW China.

**56. *Galium tokyoense*** Makino, Bot. Mag. (Tokyo) 17: 72. 1903.

钝叶拉拉藤 dun ye la la teng

*Galium asprellum* Michaux var. *tokyoense* (Makino) Nakai; *G. dahuricum* Turczaninow ex Ledebour var. *tokyoense* (Makino) Cufodontis.

Herbs, perennial, erect or ascending but not clambering. Stems 30-70 cm tall, 4-angled, retrorsely aculeolate. Middle stem leaves in whorls of 5 or 6, subsessile; blade drying papery, subspatulate to obovate, (11-)17-35(-40) × (2.5-)3-7(-10)

mm, mostly retrorsely aculeolate adaxially, along midrib abaxially and always along margins, base acute, apex rounded to emarginate, abruptly cuspidate; vein 1. Inflorescences congested, cymes terminal and in axils of uppermost leaves, several to many flowered, up to 4 cm; axes rough or glabrous and smooth; bracts few and small, only on lower inflorescence branches; pedicels 1–2 mm. Ovary obovoid, ca. 0.8 mm, glabrous. Corolla white, rotate, 1.3–3.5 mm in diam., glabrous; lobes acute to obtuse. Mericarps obovoid, ca. 2 mm, glabrous, smooth or tuberculate. Fl. and fr. Jun–Jul.

Forests, grasslands, meadows, riversides, open fields; 200–900 m. Hebei, Heilongjiang, Jilin, Liaoning, Nei Mongol, Shandong [Japan, Korea].

Cufodontis (Oesterr. Bot. Z. 89: 243–244. 1940) and W. C. Chen (in FRPS 71(2): 256. 1999) treated *Galium tokyoense* as a variety of *G. dahuricum* (see discussion under that species), but in the recent *Flora of Japan* (Yamazaki, Fl. Japan 3a: 239. 1993) it is again regarded as a separate species. In view of its erect (not clambering) growth, the abruptly acuminate leaf shape, the short and post-florally not elongated pedicels, and the always glabrous fruit this rank appears quite justified.

**57. *Galium tricornerum*** Dandy, *Watsonia* 4: 47. 1957.

麦仁珠 mai ren zhu

Herbs, annual, weakly ascending to procumbent or clambering. Stems 5–80 cm tall, 4-angled, often little branched, glabrescent, densely retrorsely aculeolate on angles. Leaves in whorls of 6–8, subsessile; blade drying papery, narrowly oblanceolate to narrowly elliptic, 10–32 × 2–6 mm, glabrescent, upper side glabrous, lower side densely aculeolate along midrib, base acute, margins densely retrorsely and antrorsely aculeolate, apex acute; vein 1. Inflorescences elongated thyrsoid, cymes terminal and axillary on short lateral stems, mostly 3–5-flowered; axes retrorsely aculeolate; bracts none or leaflike and 3–5 mm; pedicels 0.3–2 mm. Ovary ellipsoid to didymous, 0.3–0.5 mm, smooth to verrucose or spinulose. Corolla white, rotate, 1–1.5 mm in diam., lobed for 2/3 or more; lobes triangular. Mericarps subglobose, ca. 3 × 4–6 mm, becoming verrucose to tuberculate but never with uncinat trichomes, pendulous on arching pedicels to 7 mm. Fl. Apr–Jun, fr. May–Mar.

Adventive weeds in meadows on mountain slopes, open fields, river beaches, ditch sides; 400–4000 m. Anhui, Gansu, Guizhou, Henan, Hubei, Jiangsu, Jiangxi, Shaanxi, Shanghai, Shanxi, Sichuan, Xinjiang, Xizang [India, Pakistan; N Africa, SW Asia, Europe, North America].

In general aspect and habit the weedy annual *Galium tricornerum* from *G. sect. Kolgyda* strongly resembles *G. spurium* and *G. aparine* but can be separated by its above glabrous leaves and its verrucose fruit on arching pedicels. *Galium tricornerum* apparently is rare in China. The above wide distribution data from FRPS evidently is due to misidentifications of the common *G. spurium*.

*Galium tricornerum* has long been treated under the illegitimate superfluous name *G. tricorne* Stokes, published in 1787. Stokes's intent was to transfer *Valantia aparine* Linnaeus (= *G. verrucosum* Hudson, 1767) to *Galium*, where the epithet "*aparine*" was blocked by *G. aparine* Linnaeus. The specimens on which Stokes based his name belonged partly to *G. verrucosum* and partly to *G. tricornerum*, two close but very well-separated species. However, when Stokes published his article, the previously and validly published name in *Galium* by Hudson

(1767) already existed and made his name superfluous. That remained unnoticed and *G. tricorne* was generally used for our species. Only in 1975 did Dandy clarify this situation, designating *G. tricornerum* as the new name for the long known but misnamed *G. tricorne*.

**58. *Galium trifloriforme*** Komarov, *Trudy Imp. S.-Peterburgsk. Bot. Sada* 18: 428. 1901.

拟三花拉拉藤 ni san hua la la teng

Herbs, perennial, from elongated rhizomes. Stems procumbent to erect, (10–)25–40(–65) cm tall, 4-angled, mostly slightly retrorsely aculeolate, hirtellous at nodes. Leaves on main stems in whorls of up to 6(–8), subsessile; blade drying papery, blackish or green, narrowly obovate to oblanceolate, (12–)18–28(–50) × (3–)5–10(–15) mm, with sparse antrorse microhairs adaxially, moderately retrorsely aculeolate abaxially on vein and at leaf margins, base acute to cuneate, margins flat to thinly revolute, apex acute, obtuse, or rounded and abruptly mucronate; vein 1. Inflorescences with axillary and terminal cymes on upper 2 or 3 nodes, mostly 2–8-flowered; axes glabrous, smooth; bracts none or few, narrowly elliptic to narrowly lanceolate, 2–5 mm; pedicels ca. 1.5 mm. Ovary obovoid, ca. 0.5 mm, densely hispidulous with undeveloped trichomes. Corolla white or pale green, rotate, 1.5–2 mm in diam., glabrous; lobes 4, triangular, acute. Mericarps ellipsoid, 1.5–2.5 mm, with dense uncinat trichomes ca. 1 mm, fruiting pedicels divaricate and elongating to 10 mm. Fl. and fr. Jul–Sep.

Mountain forests, open fields; 2200–3400 m. Heilongjiang, Jilin, Nei Mongol, Qinghai [Japan, Korea, NE Russia].

*Galium trifloriforme* is a variable and problematic taxon from NE Asia. It was either accepted as a separate species (e.g., by Pobedimova et al., Fl. URSS 23: 303. 1958; Yamazaki, Fl. Japan 3a: 239. 1993) or was treated as a synonym of *G. triflorum* (see Cufodontis, Oesterr. Bot. Z. 89: 236–237. 1940) or of *G. hoffmeisteri* (e.g., W. C. Chen in FRPS 71(2): 230. 1999, as *G. asperuloides* subsp. *hoffmeisteri*; Govaerts et al., World Checkl. Rubiaceae; <http://www.kew.org/wcsp/rubiaceae/>; accessed on 15 Sep 2010). It differs from the very close typical *G. triflorum* by its more condensed inflorescence with cymes terminal and on the upper 1 or 2(or 3) nodes, its always retrorsely aculeolate leaf margins, and its mostly rough stems.

These differential characters make *Galium trifloriforme* a link between members of *G. sect. Hylaea*, with smooth stems and antrorsely directed microhairs on leaf margins, and of the *G. asperifolium* group of *G. sect. Trachygalium*, mostly with retrorsely aculeolate stems and retrorse microhairs on leaf margins (but often also with antrorse microhairs on the adaxial leaf surface). From the available material, it appears that *G. trifloriforme* applies to the central part of this practically continuous morphological series. This series begins with *G. odoratum*, *G. hoffmeisteri*, *G. echinocarpum*, *G. nipponicum*, and typical *G. triflorum* on the side of *G. sect. Hylaea*, continues via *G. triflorum* var. *asprelliforme* Fernald and *G. trifloriforme*, and ends on the other side with *G. asprellum*, *G. dahuricum*, *G. blinii*, and other typical members of the *G. asperifolium* group of *G. sect. Trachygalium*. It is remarkable that this transitional series apparently corresponds to a polyploid complex with marginal taxa including 2x-, *G. triflorum* 4x- and 6x-, and *G. trifloriforme* ± 10x-cytotypes. Thus, phylogenetic reticulation may have caused the still insufficiently resolved taxonomic confusion around *G. triflorum*, *G. trifloriforme*, and their relatives (cf. Pobedimova et al., loc. cit.: 287–381; Cufodontis, loc. cit.; Yamazaki, loc. cit.; Ehrendorfer et al., Fl. Iranica 176: 182. 2005).

Among the relatively few relevant PE, KUN, and WU specimens we have seen from China and the Himalaya only two typical *Galium triflorum* specimens with antorsely aculeolate leaf margins were found (see there); otherwise, only plants corresponding to the above description of *G. trifloriforme* with leaf margins retrorsely aculeolate were seen. This finding is in conflict with W. C. Chen (loc. cit.) who accepted only *G. triflorum* for the Chinese flora, but certainly needs verification from more extensive studies including Korea (from where *G. trifloriforme* was described) as well as adjacent NE Siberia and Japan, where both taxa apparently occur.

**59. *Galium triflorum*** Michaux, Fl. Bor.-Amer. 1: 80. 1803.

三花拉拉藤 san hua la la teng

Herbs, perennial, from slender rhizomes. Stems procumbent, ascending or erect, (15–)25–80(–125) cm tall, 4-angled, usually glabrous and smooth (rarely somewhat retrorsely aculeolate), hirtellous at nodes. Leaves in whorls of up to 6(–8), subsessile; blade drying papery, sometimes blackening, narrowly obovate to broadly (ob)lanceolate, (15–)20–35(–45) × (3–)6–12(–16) mm, ± glabrous but with appressed and antrorse microhairs adaxially and antrorse aculei along margins, base acute to cuneate, margin flat to thinly revolute, apex acute or rounded and abruptly mucronate; vein 1. Inflorescences terminal and axillary, with few- to several-flowered cymes at upper 2–4 stem nodes; axes glabrous and smooth; bracts few, narrowly elliptic to narrowly lanceolate, 2–5 mm; pedicels ca. 1.5 mm. Ovary obovoid, ca. 0.5 mm, densely hispidulous with undeveloped trichomes. Corolla white or greenish, rotate, 1.5–2 mm in diam., lobed for 3/4 or more, glabrous; lobes 4, triangular, acute. Mericarps ellipsoid, 1.5–2.5 mm, with dense uncinat trichomes ca. 1 mm, on pedicels elongating up to 10 mm. Fl. and fr. Jul–Sep.

Mountain forests; 1500–2000 m. Guizhou, Sichuan [Japan, Korea, Russia; Europe, North America].

*Galium triflorum* is obviously rare in China and does not occur in the Himalaya, as already suspected by Pobedimova et al. (Fl. URSS 23: 300–303. 1958). We have seen only two non-flowering specimens from SW China (Guizhou: Northern Qian [Guizhou] Team 907, PE; Sichuan: G. H. Yang 54472, PE), which apparently belong here. Indications for more northern provinces by W. C. Chen (FRPS 71(2): 232. 1999) have been listed here under *G. trifloriforme* (see there), a taxon not recognized as distinct by W. C. Chen (loc. cit.: 230). Both taxa urgently need more detailed study. *Galium triflorum* is very similar and morphologically subcontinuous with *G. trifloriforme* but differs from it by its more elongate inflorescences, mostly smooth stems, and particularly by its antorsely aculeolate leaf margins. This latter character clearly places it into *G. sect. Hylaea* and into the close neighborhood of *G. hoffmeisteri* on the mainland, *G. echinocarpum* on Taiwan, and *G. nipponicum* in Japan.

**60. *Galium turkestanicum*** Pobedimova in Schischkin, Fl. URSS 23: 717. 1958.

中亚拉拉藤 zhong ya la la teng

Herbs, perennial, erect, to 0.55 m tall. Rhizomes slender, reddish. Stems 4-angled, glabrous and smooth except puberulent to hispidulous at nodes. Leaves in whorls of 4, sessile; blade drying papery, linear or linear-lanceolate, 27–40 × 3–9 mm, glabrous or antorsely scabrous along midrib and margins, base obtuse to rounded, apex narrowed then shortly obtuse; principal vein 1, with 2 weaker lateral veins reticulating near middle of blade. Inflorescences terminal, paniculate, many

flowered, 2–15 cm; peduncles glabrous or scabrous; bracts few, oblanceolate, 1–2 mm; pedicels 1–4 mm. Ovary ellipsoid and laterally flattened, ca. 1 mm. Corolla whitish, rotate, 4–5 mm in diam.; lobes 4(or 5), elliptic to lanceolate, acute or mucronulate. Mericarps ellipsoid, at least 2 mm, glabrous or with ± sparse hooked trichomes ca. 0.3 mm. Fl. Jul–Aug, fr. Aug–Sep.

Meadows and dry slopes in the (sub)alpine zone. Expected in Xinjiang [Kazakhstan, Russia].

*Galium turkestanicum* is included as a dubious species for W China by W. C. Chen (FRPS 71(2): 285. 1999). It belongs to the extremely polymorphic *G. boreale* group of *G. sect. Platygali* s.l. and represents a particularly vigorous taxon with very narrow leaves and lateral leaf veins only weakly developed (Ehrendorfer et al., Fl. Iranica 176: 180. 2005). Pobedimova (loc. cit.) gives its distribution as including the Tien Shan. Therefore, it probably also occurs in NW China, Xinjiang.

**61. *Galium uliginosum*** Linnaeus, Sp. Pl. 1: 106. 1753.

沼猪殃殃 zhao zhu yang yang

Herbs, perennial, tender, from slender rhizomes. Stems 10–60 cm tall, somewhat retrorsely aculeolate along 4 angles. Leaves of middle stem region in whorls of 6–8, sessile; blade drying papery and glossy, narrowly oblanceolate or narrowly elliptic-lanceolate, 3–16 × 1–3 mm, glabrous, ± retrorsely aculeolate on veins and margins, base acute, apex acute; vein 1. Inflorescences terminal and in upper leaf axils, with 2- to several-flowered cymes of 2–5 cm; axes glabrous, smooth; bracts none or inconspicuous, 2–4 mm; pedicels 1–5 mm. Ovary ellipsoid, ca. 0.5 mm, glabrous. Corolla white, subcampanulate, 2–3 mm in diam., lobed for ca. 2/3; lobes 4, triangular, acute. Mericarps obovoid, ca. 1 × 1.5–2 mm, glabrous, smooth or granular. Fl. and fr. Jun–Aug.

Wet grasslands; ca. 2600 m. ?Sichuan, Xinjiang, ?Yunnan [Mongolia, Russia; C and SW Asia, Europe].

*Galium uliginosum* is a typical member of *G. sect. Trachygalium* and closely related to the *G. rivale* group, represented in China by *G. karataviense*. It differs from it by a much more slender habit and much shorter corolla tubes. All other Chinese species of *G. sect. Trachygalium* s.l. have rotate corollas.

We have seen specimens of *Galium uliginosum* from Xinjiang only. In view of the more northerly distribution of the species, the indications for Sichuan and Yunnan (in FRPS 71(2): 258. 1999) may refer to another taxon and should be verified.

**62. *Galium verum*** Linnaeus, Sp. Pl. 1: 107. 1753.

蓬子菜 peng zi cai

Herbs, perennial, with rootstock and rhizomes. Stems erect, (5–)15–70(–120) cm tall, 4-angled, densely puberulent, villosulous, or hirtellous to rarely glabrous and smooth. Leaves in middle stem region in whorls of more than 6 and up to 12, sessile; blade drying papery to subleathery, often blackening, adaxially rather shiny, abaxially paler, linear to linear-oblong, 10–30(–50) × 1–2(–2.5) mm, adaxially glabrous to densely hairy, smooth to sparsely aculeolate, abaxially usually densely puberulent to tomentose, rarely glabrescent or glabrous, base acute to cuneate, margins usually strongly revolute and antorsely aculeolate, apex acute and shortly mucronate with tip to 1.5 mm; vein 1. Inflorescences thyrsoid or paniculate, terminal and axillary cymes few to many flowered, rather dense and

bracteose; axes usually densely puberulent, hirtellous, rarely glabrous and smooth; bracts ± leaflike, 1.5–3 mm; pedicels 1–3 mm. Flowers fragrant, hermaphroditic. Ovary ellipsoid to subglobose, 0.5–0.8 mm, glabrous to densely hairy with straight trichomes. Corolla yellow to white, rotate, ca. 3 mm in diam., glabrous, lobed for 3/4 or more; lobes 4, lanceolate-oblong, subobtusate, acute to apiculate. Mericarps ellipsoid and laterally flattened, 1.5–2 mm, glabrous to densely hispidulous with straight trichomes. Fl. Apr–Aug, fr. May–Oct.

Mountains, grasslands, meadows, river beaches, open fields, ditch sides, streamsides, wet places, forests, thickets, valleys; near sea level to 4100 m. Anhui, Gansu, Hebei, Heilongjiang, Henan, Hubei, Jiangsu, Jilin, Liaoning, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shandong, Shanxi, Sichuan, Xinjiang, Xizang, Zhejiang [India, Japan, Kashmir, Kazakhstan, Korea, Mongolia, Pakistan, Russia, Turkmenistan, Uzbekistan; SW Asia, Europe; adventive in North America and elsewhere].

*Galium verum* is used medicinally and ranks among the most commonly collected species of *Galium* in China, along with *G. bungei*, *G. spurium*, and *G. hoffmeisteri*. Together with closely related taxa (as *G. saurense* and *G. consanguineum* in the Chinese flora), it forms an extremely variable polyploid complex with 2x- and 4x-populations, which is still very badly understood. Together with *G. humifusum*, with which it can form a hybrid, it is placed into *G.* sect. *Galium*.

According to the considerable variation of *Galium verum* with respect to habit, indumentum of leaves, ovaries, and fruit, and flower color, Cufodontis (Oesterr. Bot. Z. 89: 216–219. 1940) and subsequently W. C. Chen (in FRPS 71(2): 266–269. 1999) have rather schematically recognized a number of varieties, which often coexist in one and the same population. Even if they do not correspond to natural entities, they are provisionally treated here for reference, in particular as to the range and adaptation to different habitats in China.

- 1a. Ovary and fruit hairy.
  - 2a. Leaves pubescent and scabrous adaxially ..... 62e. var. *tomentosum*
  - 2b. Leaves glabrous and smooth adaxially ..... 62f. var. *trachycarpum*
- 1b. Ovary and fruit glabrous.
  - 3a. Corolla yellow.
    - 4a. Leaves pubescent and scabrous adaxially ..... 62g. var. *trachyphyllum*
    - 4b. Leaves glabrous and smooth adaxially.
      - 5a. Plants to over 1 m tall; leaves to 5–7 cm ..... 62a. var. *asiaticum*
      - 5b. Plants to 45 cm tall; leaves usually 1.5–3 cm .... 62h. var. *verum*
  - 3b. Corolla pale yellow or white.
    - 6a. Corolla pale yellow ..... 62c. var. *leiophyllum*
    - 6b. Corolla white.
      - 7a. Leaves pubescent and scabrous adaxially ..... 62b. var. *lacteum*
      - 7b. Leaves glabrous and smooth adaxially ..... 62d. var. *nikkoense*

**62a. *Galium verum* var. *asiaticum*** Nakai, J. Jap. Bot. 15: 344. 1939.

长叶蓬子菜 chang ye peng zi cai

*Galium verum* subsp. *asiaticum* (Nakai) T. Yamazaki.

Plants stout, 50–120 cm tall. Leaf blade to 5–7 cm, gla-

brous and smooth adaxially. Corolla yellow. Ovary and mericarps glabrous. Fl. and fr. Jun–Aug.

Mountain grasslands, open fields, river beaches; below 100–1700 m. Anhui, Gansu, Hebei, Heilongjiang, ?Henan, Hubei, Jiangsu, Jilin, Liaoning, Nei Mongol, Shandong, Shanxi, Sichuan, Zhejiang [Japan, Korea, Russia].

According to Yamazaki (Fl. Japan 3a: 240. 1993) *Galium verum* subsp. *asiaticum* includes all Japanese forms of *G. verum* and differs from the typical subspecies by longer leaves and hirsute (not minutely pubescent) stems.

**62b. *Galium verum* var. *lacteum*** Maximowicz, Bull. Acad. Imp. Sci. Saint-Petersbourg 19: 283. 1874.

白花蓬子菜 bai hua peng zi cai

*Galium verum* f. *lacteum* (Maximowicz) Nakai.

Leaf blade pubescent and scabrous adaxially. Corolla white. Ovary and mericarps glabrous.

Wet places on mountains and in open fields; 500–1000 m. Gansu, Hebei, Heilongjiang, Jilin, Liaoning, Ningxia, Shaanxi [Japan, Korea].

Yamazaki (loc. cit.: 240) treated this as a form within *Galium verum* subsp. *asiaticum* and listed *G. verum* f. *nikkoense* as a synonym of *G. verum* f. *lacteum*.

**62c. *Galium verum* var. *leiophyllum*** Walldroth, Sched. Crit. 56. 1822.

淡黄蓬子菜 dan huang peng zi cai

Corolla pale yellow. Ovary and mericarps glabrous. Fl. Jun–Jul.

Mountain grasslands, open fields; ca. 600 m. Hebei, Liaoning, Shandong [?Japan; Europe].

Although W. C. Chen (loc. cit.: 268) included Japan in the distribution of this variety, its name is not mentioned in Fl. Japan.

**62d. *Galium verum* var. *nikkoense*** Nakai, J. Jap. Bot. 15: 347. 1939.

日光蓬子菜 ri guang peng zi cai

*Galium verum* f. *nikkoense* (Nakai) Ohwi.

Leaf blade glabrous and smooth adaxially. Corolla white. Ovary and mericarps glabrous.

Shandong [Japan].

Yamazaki (loc. cit.: 240) treated this variety as a synonym of *Galium verum* f. *lacteum*.

**62e. *Galium verum* var. *tomentosum*** C. A. Meyer, Verz. Pfl. Casp. Meer. 54. 1831.

毛蓬子菜 mao peng zi cai

*Galium verum* f. *tomentosum* (C. A. Meyer) Nakai.

Leaf blade pubescent and scabrous adaxially. Ovary and mericarps pilose. Fl. and fr. Jun–Sep.

Forests on mountain slopes, farmland sides, grasslands; 400–3100 m. Gansu, Hebei, Heilongjiang, Jilin, Liaoning, Nei Mongol, Qinghai, Shanxi, Sichuan, Xinjiang [Japan].

The type of the name of this variety comes from SW Asia (S Azerbaijan: Talysh) and may not fully conform to the Chinese popula-

tions listed here. Although Nakai (Bot. Mag. (Tokyo) 34: 50–51. 1920; J. Jap. Bot. 15: 348. 1939) and W. C. Chen (loc. cit.: 269) included Japan in the distribution of this taxon, its name is not mentioned in Fl. Japan. In the older literature, specimens with hairy ovaries and fruit, corresponding to this and the following *Galium verum* var. *trachycarpum*, often have been called *G. ruthenicum* Willdenow.

With respect to the synonymy one has to consider the following: Nakai (loc. cit. 1939) under *Galium verum* var. *tomentosum* “Nakai, comb. nov.,” cited “*Galium verum* var. *luteum* f. *tomentosum* Nakai,” where (loc. cit. 1920) he cited “*G. verum* var. c. Ledebour Fl. Ross. II. p. 415,” where Ledebour wrote “c. caule fructibusque tomento denso vestitis. C. A. Meyer l.c. Hab. in provinciis caucasicis [in m. Talüsch, alt. 1100 hexap. (C. A. Meyer),” giving the reference to Meyer on p. 414 as “Ind. cauc. p. 54,” i.e., Verz. Pfl. Casp. Meer. 54. 1831, where Meyer wrote “[var.] *δ tomentosum*. caule et mericarpis tomento denso vestitis. In cacumine montium Talüsch prope pagum Drych, in rupestribus siccis sterilissimis (alt. 1100 hexap.)” It is evident, therefore, that Nakai in 1920 was not publishing the name of a new taxon but a status novus at the rank of forma with an indirect reference (allowed before 1953; *Vienna Code*, Art. 33.2) to the basionym, i.e., Meyer’s varietal name.

**62f. *Galium verum* var. *trachycarpum*** Candolle, Prodr. 4: 603. 1830.

毛果蓬子菜 mao guo peng zi cai

*Galium verum* var. *lasiocarpum* Ledebour.

Leaf blade glabrous and smooth adaxially. Ovary and mericarps pilose. Fl. and fr. Jun–Sep.

Forests, thickets, or grasslands on mountain slopes, streamsides, open fields, river beaches; 100–3900 m. Gansu, Hebei, Heilongjiang, Henan, Jilin, Liaoning, Nei Mongol, Qinghai, Shanxi, Sichuan, Xinjiang, Xizang, Zhejiang [Japan, Korea, Russia; Europe].

This variety (including its synonym) was included by Ehrendorfer et al. (Fl. Iranica 176: 200. 2005) in *Galium verum* f. *subpubescens* Sergievskaya, to which it corresponds. Yamazaki (loc. cit.: 240) recognized *G. verum* f. *album* Nakai for white-flowered plants of this variety.

**62g. *Galium verum* var. *trachyphyllum*** Wallroth, Sched. Crit. 56. 1822.

粗糙蓬子菜 cu cao peng zi cai

Leaf blade pubescent and scabrous adaxially. Corolla yellow. Ovary and mericarps glabrous. Fl. May–Aug, fr. Aug–Sep.

Forests or grasslands on mountain slopes or in valleys, open fields, river beaches; 300–4100 m. Anhui, Gansu, Hebei, Heilongjiang, Henan, Jiangsu, Jilin, Liaoning, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shandong, Shanxi, Sichuan, Xinjiang [Korea; Europe].

**62h. *Galium verum* var. *verum***

蓬子菜(原变种) peng zi cai (yuan bian zhong)

*Galium luteum* Lamarck; *G. verum* var. *leiocarpum* Ledebour; *G. verum* var. *luteum* (Lamarck) Nakai.

Plants to 45 cm tall. Leaf blade usually 1.5–3 cm, glabrous and smooth adaxially. Corolla yellow. Ovary and mericarps gla-

brous. Fl. Apr–Aug, fr. May–Oct.

Mountains, river beaches, open fields, ditch sides, grasslands, meadows, thickets, forests; near sea level to 4000 m. Gansu, Hebei, Heilongjiang, Jilin, Liaoning, Nei Mongol, Qinghai, Shandong, Shanxi, Sichuan, Xinjiang, Xizang [India, Japan, Korea, Pakistan; SW Asia, Europe; adventive in North America and elsewhere].

The citation here of *Galium luteum*, a long-recognized synonym of *G. verum* based on a type from France, follows W. C. Chen (loc. cit.: 266). Ehrendorfer et al. (loc. cit.: 200–201) recognized two forms within *G. verum* subsp. *verum*, separated by density and distribution of pubescence: f. *verum* with glabrous ovaries and fruit vs. f. *subpubescens* with pubescent ovaries and fruit. Thus, their f. *subpubescens* corresponds to var. *tomentosum* and var. *trachycarpum* of Cufodontis (loc. cit.: 216–219) and W. C. Chen (loc. cit.: 268–269).

**63. *Galium yunnanense*** H. Hara & C. Y. Wu, J. Jap. Bot. 61: 74. 1986.

滇拉拉藤 dian la la teng

*Galium elegans* Wallich var. *angustifolium* Cufodontis; *G. elegans* var. *nemorosum* Cufodontis.

Herbs, perennial, procumbent to scrambling or matted, up to 1 m, from slender rhizomes. Stems glabrescent and smooth to sparsely or moderately pilose to villous or retrorsely hispid, nodes more densely hairy, angles 4, usually thickened. Leaves in whorls of 4, subsessile; blade drying membranous, green, elliptic, ovate-lanceolate, or lanceolate, 5–50 × 3–15 mm, length/breadth index normally above 2.5, adaxially hispidulous to hirsute, abaxially glabrescent to densely pilose and usually glandular-punctate, base cuneate to obtuse, margins sparsely to densely pilose or antrorsely ciliate, apex acute to acuminate and often mucronulate; principal veins 3, palmate. Inflorescences terminal and in axils of uppermost leaves, paniculate, many flowered, 2–12 cm, diffusely branched; peduncles pilose to glabrescent; bracts inconspicuous, ligulate to ovate, 1.5–2.5 mm, often lacking upward; pedicels 2.5–7 mm. Flowers dioecious, polygamous, or ?hermaphroditic. Ovary obovoid, ca. 0.5 mm, densely appressed hairy. Corolla white, rotate, 1–1.5 mm in diam.; lobes 4, ovate, subacute. Mericarps ovoid, 1.5–2 mm, with dense, uncinat, stiff and spreading, basally white to apically brown trichomes ca. 0.8 mm. Fl. and fr. Jul–Nov.

• Forests, meadows on mountains, riversides, streamsides; 700–3300 m. Gansu, Guangxi, Guizhou, Hunan, Sichuan, Yunnan.

As noted in the protologue, *Galium yunnanense* is similar to *G. elegans* and comprises plants that previously have been included in a more broadly circumscribed *G. elegans*. In particular, the two varieties of *G. elegans* described by Cufodontis in 1940 and cited as synonyms above now key to *G. yunnanense*. In spite of its variability and occasional forms approaching *G. bungei* (see there), the specific separation of *G. yunnanense* from *G. elegans* by Chen (Acta Phytotax. Sin. 28: 301. 1990) seems well justified. It reduces the morphological variation within *G. elegans* and results in a much clearer circumscription of the two taxa.

## 29. GARDENIA J. Ellis, Philos. Trans. 51: 935. 1761, nom. cons., not Colden (1756).

梔子属 zhi zi shu

Chen Tao (陈涛); Charlotte M. Taylor

Shrubs or rarely trees, sometimes with short shoots (*Gardenia angkorensis*, *G. sootepensis*), unarmed or with short shoots

sometimes spinescent, with buds and young stem apices often resinous. Raphides absent. Leaves opposite or rarely ternate, sometimes clustered at stem apices, often with domatia; stipules persistent or deciduous, united shortly around stem or united completely into a conical cap (i.e., calyptrate), triangular or when united into a cap then splitting along one side. Inflorescences pseudoaxillary and/or terminal, fascicled to cymose and several flowered or reduced to 1 flower, pedunculate to sessile, bracteate. Flowers sessile to pedicellate, bisexual, monomorphic, often showy. Calyx with ovary portion well developed and often longitudinally ridged; limb 5–8-lobed or sometimes fused into a tube or conical cap that splits irregularly as corolla elongates (i.e., spathaceous), often well developed. Corolla white to cream, salverform or funnelform, glabrous or variously pubescent inside; lobes 5–12, convolute in bud. Stamens 5–12, inserted in corolla throat, included or partially exserted; filaments very short or reduced; anthers dorsifixed. Ovary 1-celled, ovules numerous on 2–6 parietal placentas; stigma clavate or 2-lobed, included or exserted. Fruit generally yellow to orange, red-orange, or brown with pulp usually orange, baccate, leathery or fleshy, ellipsoid to subglobose, smooth or with longitudinal ridges, with calyx limb usually persistent or sometimes upper part tardily deciduous; seeds numerous, medium-sized, ellipsoid, compressed, embedded in pulp; testa leathery or membranous; endosperm usually corneous; embryo small or medium-sized; cotyledons broad, leaflike.

About 60–200 or 250 species: tropical and subtropical regions of Africa, Asia, Madagascar, and Pacific islands; five species (one endemic) in China.

The persistent calyx lobes apparently enlarge markedly as the fruit develop in many species; this may be confusing when the enlarged fruiting calyx lobes are compared with descriptions of flowering calyx lobes. The flowers are often nocturnal and are usually strongly sweetly fragrant with an odor of, well, gardenia. Several species from Asia and the Pacific are occasionally cultivated, but *Gardenia jasminoides*—native to our region—is very popular worldwide for its flowers.

- 1a. Leaf blade puberulent or pilosulous to glabrous adaxially, densely tomentose abaxially; stipules and calyx limb each fused into a conical cap then splitting along one side; fruit with spathaceous upper portion of calyx limb deciduous ..... 4. *G. sootepensis*
- 1b. Leaf blade glabrous to puberulent or pilosulous; stipules united in basal portion with apical portions free or fused into a conical cap, calyx regularly lobed; fruit with calyx lobes persistent.
- 2a. Leaf blade 1.5–4 × 1–2.5 cm, obovate or spatulate, obtuse to rounded at apex; calyx lobes 4–5 mm in flower, 5–8 mm in fruit ..... 1. *G. angkorensis*
- 2b. Leaf blade 3–25 × 0.4–8 cm, acute, acuminate, or obtuse at apex; calyx lobes 4–30 mm in flower, to 40 mm in fruit.
- 3a. Leaves ternate or sometimes opposite on a few nodes, with blade narrowly lanceolate or linear-lanceolate, 0.4–2.3 cm wide, without domatia; fruit ellipsoid-oblong to ellipsoid, 1.5–2.5 × 1–1.3 cm, smooth or with 5–8 weak to developed longitudinal ridges ..... 5. *G. stenophylla*
- 3b. Leaves opposite or sometimes ternate on a few nodes, with blade oblanceolate, obovate-oblong, elliptic-oblong, lanceolate-oblong, obovate, or elliptic, 1.5–8 cm wide, without or usually with domatia; fruit ovoid-ellipsoid, subglobose, or ellipsoid, 1.5–7 × 1.2–2 cm, smooth or with 5–9 weak to well-developed longitudinal ridges.
- 4a. Trees; calyx lobes 4–7 mm in flower; corolla tube ca. 15 mm, shorter than lobes; fruit with 5 weak to well-developed longitudinal ridges ..... 2. *G. hainanensis*
- 4b. Shrubs; calyx lobes 10–30 mm in flower; corolla tube 30–50 mm, ± equal to or usually longer than lobes; fruit with 5–9 well-developed longitudinal ridges ..... 3. *G. jasminoides*

**1. *Gardenia angkorensis*** Pitard in Lecomte, Fl. Indo-Chine 3: 252. 1923.

匙叶梔子 *chi ye zhi zi*

Shrubs, 1–3 m tall, with short shoots; branches terete, glabrous, becoming grayish white. Leaves opposite, usually crowded at ends of short shoots; petiole 1–4 mm, puberulent to glabrous; blade drying stiffly papery, obovate or spatulate, 1.5–4 × 1–2.5 cm, adaxially glabrous and shiny, abaxially sparsely puberulent to glabrous, base cuneate to acute, apex obtuse to rounded; secondary veins 6–8 pairs, in abaxial axils with pubescent foveolate domatia; stipules united shortly around stem, broadly triangular to ligulate, 2–3 mm, glabrous, obtuse to rounded. Flowers solitary, terminal on short shoots, sessile or subsessile. Calyx puberulent to glabrescent; ovary portion obconical, weakly ridged, 7–8 mm; limb lobed nearly to base; lobes 6, narrowly spatulate, 4–5 mm, obtuse. Corolla outside glabrous; tube 13–15 mm, somewhat funnelform; lobes 6, spatulate, ca. 15 mm, obtuse. Fruiting pedicels to 3 mm. Berry ellip-

soid to subglobose, 15–18 × 10–15 mm, smooth to weakly ridged, with persistent calyx lobes 7–8 mm; seeds ca. 5 × 3–4 mm. Fr. Aug–Dec.

Forests or thickets at streamsides in valleys or on mountain slopes. Hainan [Cambodia].

**2. *Gardenia hainanensis*** Merrill, Lingnan Sci. J. 9: 43. 1930.

海南梔子 *hai nan zhi zi*

Trees, 3–12 m tall; branches with internodes congested to developed, compressed to terete, densely puberulent to glabrous, resinous at apices with usually distalmost several internodes coated with dried resin, becoming straw-brown. Leaves opposite; petiole 0.2–1 cm, puberulent to glabrous; blade drying thinly leathery, bright to dull or yellowed green adaxially, similar but darker or paler abaxially, obovate-oblong, elliptic-oblong, or oblanceolate, 5–19.5 × 2–8 cm, adaxially shiny and glabrous, abaxially glabrous to puberulent, base cuneate to acute, apex acute or shortly acuminate with tip often ultimately

obtuse; secondary veins 10–15 pairs, in abaxial axils with pilosulous domatia; stipules calyptrate, conical, 4–10 mm, splitting for 1/2–3/4 their length, puberulent to usually glabrous. Flowers solitary, terminal or pseudoaxillary; peduncle 0.4–0.8 cm, densely puberulent. Calyx puberulent, usually covered with resin; ovary portion broadly obconical to ellipsoid, 5-ridged, 5–6 mm; limb with tubular portion 3–4 mm; lobes 5, oblong-lanceolate to linear or spatulate, 4–7 mm, 1–1.6 mm wide at base, strongly keeled, narrowed then ultimately rounded at apex. Corolla outside apparently glabrous, often covered with resin; tube ca. 15 mm, somewhat funnellform; lobes 5, obovate-oblong to elliptic, 23–30 × 8–10 mm, acute to obtuse and apiculate. Fruiting peduncles to 2 cm. Berry yellow, subglobose or ovoid-ellipsoid to ellipsoid, 1.6–3.3 × 1.5–1.6 cm, with 5 weak to developed longitudinal ridges, with persistent calyx limb. Fl. Apr, fr. May–Oct.

• Forests at streamsides in valleys or on mountain slopes; below 100–1200 m. Guangxi (Shangsi), Hainan.

### 3. *Gardenia jasminoides* J. Ellis, Philos. Trans. 51: 935. 1761.

梔子 zhi zi

Shrubs, 0.3–3 m tall; branches terete to flattened, with internodes developed to shortened, glabrescent or usually densely puberulent to pilosulous, becoming gray to grayish white, with buds resinous and distalmost internodes often covered with resin. Leaves opposite or rarely ternate, subsessile to petiolate; petiole to 0.5(–1) cm, densely puberulent or shortly pilosulous to glabrous; blade drying thinly leathery to stiffly papery, oblong-lanceolate, obovate-oblong, obovate, oblanceolate, or elliptic, 3–25 × 1.5–8 cm, adaxially shiny and glabrous or sometimes puberulent on principal veins, abaxially puberulent or pilosulous to glabrous, base cuneate to acute, apex acute to acuminate or obtuse then abruptly long acuminate; secondary veins 8–15 pairs, in abaxial axils often with pilosulous domatia; stipules calyptrate, cylindrical, 4–13 mm, splitting for ca. 3/4 their length, densely puberulent to glabrous. Flower solitary, terminal; peduncle 1–10 mm, puberulent or pilosulous to glabrous. Calyx puberulent or pilosulous to glabrous; ovary portion obconic or obovoid, 5–8 mm, with (5 or)6(–8) weak to developed longitudinal ridges; limb with basal tubular portion 3–5 mm; lobes (5 or)6(–8), lanceolate or linear-lanceolate to spatulate, 10–30 × 1–4 mm, often strongly keeled, acute. Corolla white to pale yellow, simple or in cultivation sometimes doubled, outside glabrous; tube 30–50 × 4–6 mm, cylindrical, in throat pilose; lobes (5 or)6(–8) or numerous when doubled, obovate or obovate-oblong, 15–40 × 6–28 mm, obtuse to rounded. Fruiting peduncles apparently not much elongating. Berry yellow or orange-yellow, ovoid, subglobose, or ellipsoid, 1.5–7 × 1.2–2 cm, with 5–9 longitudinal ridges, with persistent calyx lobes to 40 × 6 mm; seeds suborbicular, weakly angled, ca. 3.5 × 3 mm. Fl. Mar–Jul, fr. May–Feb.

Thickets and forests at streamsides, on mountain slopes or hills, or in valleys or fields; near sea level to 1500 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hebei, Hubei, Hunan, Jiangsu, Jiangxi, Shandong, Sichuan, Taiwan, Yunnan, Zhejiang; cultivated in Gansu, Hebei, Shanxi [Bhutan, Cambodia, India, Japan, N Korea, Laos, Nepal, Pakistan, Thailand, Vietnam; cultivated in Africa, Asia, Australia, Europe, North and South America, and Pacific islands].

This is one of the most commonly collected species of Rubiaceae in China. It is quite variable morphologically especially in leaf size, calyx lobe size, and corolla size. Several varieties have been recognized for Chinese plants (e.g., Qiu & Zhong, Fl. Zhejiang 6: 105. 1986) but are not clearly separated or widely accepted outside this region. The varieties recognized by W. C. Chen (in FRPS 71(1): 332–335. 1999) are outlined below for reference.

- 1a. Corolla doubled; flowers sterile, plants not setting fruit; cultivated plants ..... 3a. var. *fortuneana*
- 1b. Corolla simple; flowers fertile, plants setting fruit; wild and occasionally cultivated plants ..... 3b. var. *jasminoides*

### 3a. *Gardenia jasminoides* var. *fortuneana* (Lindley) H. Hara, Enum. Sperm. Jap. 2: 15. 1952 [“*fortuniana*”].

白蟾 bai chan

*Gardenia florida* Linnaeus var. *fortuneana* Lindley, Edwards’s Bot. Reg. 32: t. 43. 1846 [“*fortuniana*”].

Flowers with doubled corolla, sterile. Fl. throughout year.

Cultivated in gardens and green belts as an ornamental in provinces of S China (including Nanhai Zhudao) [cultivated worldwide, outdoors in tropical regions and indoors in temperate regions].

### 3b. *Gardenia jasminoides* var. *jasminoides*

梔子(原变种) zhi zi (yuan bian zhong)

*Gardenia florida* Linnaeus, nom. illeg. superfl.; *G. florida* f. *oblanceolata* Nakai; *G. florida* var. *ovalifolia* Sims; *G. florida* f. *simpliciflora* Makino; *G. grandiflora* Loureiro; *G. jasminoides* f. *grandiflora* (Loureiro) Makino; *G. jasminoides* var. *grandiflora* (Loureiro) Nakai; *G. jasminoides* var. *longispala* (Masamune) F. P. Metcalf; *G. jasminoides* f. *maruba* (Siebold ex Blume) Nakai ex Ishii; *G. jasminoides* var. *maruba* (Siebold ex Blume) Nakai; *G. jasminoides* f. *oblanceolata* (Nakai) Nakai; *G. jasminoides* f. *ovalifolia* (Sims) H. Hara; *G. jasminoides* var. *ovalifolia* (Sims) Nakai; *G. jasminoides* var. *radicans* (Thunberg) Makino; *G. jasminoides* f. *simpliciflora* (Makino) Makino; *G. jasminoides* f. *variegata* (Carrière) Nakai; *G. jasminoides* var. *variegata* (Carrière) Makino; *G. maruba* Siebold ex Blume; *G. radicans* Thunberg; *G. radicans* var. *variegata* Carrière; *G. schlechteri* H. Léveillé (1911), not Bonati & Petitmengin (1907).

Flowers with simple corolla, fertile. Fl. Mar–Jul, fr. May–Feb.

Thickets and forests at streamsides, on mountain slopes or hills, or in valleys or fields; near sea level to 1500 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hebei, Hunan, Jiangsu, Jiangxi, Shandong, Sichuan, Taiwan, Yunnan, Zhejiang; cultivated in Gansu, Hebei, Shanxi [Cambodia, India, Japan, N Korea, Laos, Nepal, Pakistan, Vietnam; cultivated in Europe, North America, Pacific islands].

### 4. *Gardenia sootepensis* Hutchinson, Bull. Misc. Inform. Kew 1911: 392. 1911.

大黃梔子 da huang zhi zi

Trees, 7–10 m tall, often with gelatinous secretions; branches with both developed and shortened internodes, somewhat compressed to angled or subterete, densely puberulent,

pilosulous, or tomentulose, becoming glabrescent. Leaves opposite; petiole 0.6–1.2 cm, puberulent or tomentulose; blade drying papery or thinly leathery, obovate, obovate-elliptic, broadly elliptic, or elliptic-oblong, 7–29 × 3–16 cm, adaxially puberulent or pilosulous to glabrous, abaxially densely tomentose, base rounded to obtuse or cuneate, apex shortly acuminate with tip acute or obtuse; secondary veins 12–20 pairs, in abaxial axils often with densely pilosulous domatia; stipules calyprate, conical, 0.5–1 cm, sericeous outside, densely puberulent or tomentulose inside, apical portion triangular and caducous, basal portion truncate to broadly rounded and usually persisting with leaves and sometimes becoming hardened. Flowers pseudoaxillary usually near branch apices, solitary; peduncle 1–1.5 cm, puberulent. Calyx densely puberulent to pilosulous externally; ovary portion ellipsoid, smooth, 5–6 mm; limb spathaceous, 13–15 mm, splitting along one side for 2/3–3/4 of its length, inside sericeous, often viscid or mucilaginous. Corolla yellow or white, salverform; tube 50–70 × 3–5 mm, cylindrical, outside sparsely puberulent, inside glabrous; lobes 5, broadly obovate, 40–50 × 20–30 mm, glabrous on both surfaces, obtuse to acute. Berry ellipsoid or ellipsoid-oblong, 2.5–5.5 × 1.5–3.5 cm, puberulent, smooth or with 5 or 6 longitudinal lines or very weak ridges, leathery to hard; seeds suborbicular, flattened, 3–4 mm in diam., foveolate. Fl. Apr–Aug, fr. Jun–Apr.

Forests at streamsides, at village margins, or on mountain slopes; 700–1600 m. Yunnan [Laos, Thailand].

W. C. Chen (in FRPS 71(1): 335. 1999) described the flowers as

terminal on branchlets, but these are pseudoaxillary on all specimens seen as described here.

**5. *Gardenia stenophylla*** Merrill, Philipp. J. Sci. 19: 678. 1922.  
狭叶梔子 xia ye zhi zi

Shrubs, 0.5–3 m tall; branches generally slender, angled to subterete, puberulent to glabrescent. Leaves opposite or ternate with arrangement often variable on a branch, subsessile to shortly petiolate; petiole to 5 mm, puberulent to glabrous; blade drying thinly leathery, narrowly lanceolate, narrowly elliptic, elliptic-spatulate, or linear-lanceolate, 3–12 × 0.4–2.3 cm, adaxially glabrous, abaxially puberulent to glabrous, base acute and often decurrent, margin thickened and often thinly revolute, apex acute to obtuse; secondary veins 9–13 pairs, in abaxial axils without domatia; stipules calyprate, conical, 7–10 mm, splitting along one side for 3/4 or more of length, glabrous. Flowers solitary, pseudoaxillary or terminal; peduncles 5–6 mm, glabrous. Calyx glabrous; ovary portion ellipsoid to cylindrical, 5–6 mm, longitudinally 5–8-ridged; limb with basal tubular portion 4–6 mm; lobes 5–8, linear to narrowly lanceolate, 7–15 mm, keeled, acute. Corolla outside glabrous; tube cylindrical, 35–65 × 3–4 mm; lobes 5–8, oblong-obovate, 25–35 × 10–15 mm, obtuse. Fruiting pedicels to 2 cm. Berry yellow or orange-red, ellipsoid-oblong to ellipsoid, 1.5–2.5 × 1–1.3 cm, with 5–8 weak to developed longitudinal ridges, with persistent calyx lobes to 2 cm; seeds 2–3 mm. Fl. Apr–Aug, fr. May–Jan.

Forests or thickets at streamsides in valleys, fields at riversides; below 100–800 m. Anhui, Guangdong, Guangxi, Hainan, Zhejiang [Vietnam].

### 30. *GEOPHILA* D. Don, Prodr. Fl. Nepal. 136. 1825, nom. cons., not Bergeret (1803).

爱地草属 ai di cao shu

Chen Tao (陈涛); Charlotte M. Taylor

*Geocardia* Standley.

Herbs, perennial, unarmed; stems creeping and rooting at nodes. Raphides present. Leaves opposite, usually broadly ovate to cordate and long petiolate, without domatia; stipules persistent, interpetiolar, generally triangular, entire [or 2-lobed]. Inflorescences terminal or pseudoaxillary, cymose to capitate, few to several flowered, pedunculate, bracteate. Flowers sessile or subsessile, bisexual, apparently monomorphic. Calyx limb 4–7-lobed. Corolla white, funnellform, inside pubescent in throat; lobes 4–7, valvate in bud. Stamens 4–7, inserted in corolla tube, included or partly exerted; filaments developed; anthers dorsifixed. Ovary 2-celled, ovules 1 in each cell, erect, basal; stigma 2-lobed, included or exerted. Fruit orange or red [or sometimes blue or black], drupaceous, globose to ellipsoid, fleshy, with calyx limb persistent; pyrenes 2, 1-celled, each with 1 seed, hard, plano-convex and sometimes longitudinally twisted, dorsally (i.e., abaxially) smooth to ridged, ventrally (i.e., adaxially) with a median ridge and 2 submarginal longitudinal grooves; seeds medium-sized; testa membranous; endosperm corneous.

About 30 species: widespread in tropical Africa, Asia, Central, North, and South America, and Madagascar; one species in China.

**1. *Geophila repens*** (Linnaeus) I. M. Johnston, Sargentia 8: 281. 1949.

爱地草 ai di cao

*Rondeletia repens* Linnaeus, Syst. Nat., ed. 10, 2: 928. 1759; *Geophila herbacea* (Jacquin) K. Schumann; *G. reniformis* D. Don; *Psychotria herbacea* Jacquin.

Herbs, perennial, creeping; stems quadrate to subterete, puberulent or hirtellous to glabrescent, vegetative creeping, 40 cm or longer, reproductive ascending, to 15 cm tall. Petiole 1–5

cm, densely puberulent to pilose or hirtellous often in lines; leaf blade drying membranous to papery and sometimes yellowish green, ovate to suborbicular, 1–3 × 1–3 cm, glabrescent on both surfaces, base cordulate to cordate, margins often undulate, apex obtuse to rounded; secondary veins 2 or 3 pairs, usually grouped in basal half of blade; stipules broadly ovate, 1–2 mm. Inflorescence with flowers 1–3 in umbelliform cymules, puberulent to hirtellous or glabrescent; peduncle 1–4 cm; bracts linear to narrowly triangular, 1.5–3 mm. Calyx glabrous to puberulent; ovary portion ellipsoid, 1.5–2 mm; limb deeply lobed; lobes 4, linear-lanceolate, 2–3 mm, ciliate. Corolla pilosulous to

glabrescent outside; tube ca. 8 mm; lobes 4, ovate or ovate-lanceolate, ca. 3 mm, acute. Drupes red, subglobose to ovoid, 4–6 mm in diam., pilosulous to glabrescent; pyrenes dorsally weakly rugulose. Fl. Jul–Sep, fr. Sep–Dec.

Forest and trail margins, ravines, damp places; 100–600 m. Guangdong, Guangxi, Guizhou, Hainan, Taiwan, Yunnan [widespread in tropical Africa, Antilles, Asia, Central America, Madagascar, North America (Mexico), and South America].

### 31. GUETTARDA Linnaeus, Sp. Pl. 2: 991. 1753.

海岸桐属 hai an tong shu

Chen Tao (陈涛); Charlotte M. Taylor

Shrubs or trees, sometimes polygamo-dioecious, unarmed. Raphides absent. Leaves opposite or rarely ternate, decussate, usually with domatia; tertiary and/or quaternary venation often arranged in regular, often small rectangles or squares; stipules caducous, interpetiolar, generally triangular. Inflorescences axillary, cymose with axes often markedly dichotomous or scorpioid, several to many flowered, pedunculate with peduncle usually elongated [to sessile], bracts reduced [to well developed]. Flowers sessile to shortly pedicellate, unisexual or bisexual and monomorphic or at least sometimes distylous, sweetly fragrant. Calyx limb tubular or subcampanulate, truncate or irregularly denticulate. Corolla white or pink, salverform with tube infrequently curved, glabrous to variously pubescent inside; lobes 4–9, obtuse, imbricate (and quincuncial) in bud. Stamens 4–9, inserted in corolla tube, included; filaments short or reduced; anthers dorsifixed. Ovary 4–9-celled, ovules 1 in each cell, pendulous from apical placentas, anatropous, with funicle thickened; stigma capitate, included. Fruit red, purple, black, or rarely green, drupaceous, thinly fleshy, oblate (i.e., depressed globose), ellipsoid, or subglobose, with calyx limb persistent; pyrene 1, 4–9-celled with 1 seed in each cell, oblate, ellipsoid, or subglobose, often 4–9-angled or -grooved, with preformed germination pore at apex of each cell; seeds medium-sized, ellipsoid, straight or curved; testa membranous; endosperm absent or scanty; embryo cylindrical or compressed; cotyledons small; radicle ascending.

About 60–80 species: tropical forests, most in tropical America and Pacific region, one species widespread on coasts of Indian Ocean and E Pacific Ocean; one species in China.

#### 1. *Guettarda speciosa* Linnaeus, Sp. Pl. 2: 991. 1753.

海岸桐 hai an tong

Small trees, 3–8 m tall; bark becoming black, smooth or often lenticellate; branchlets rather stout, densely strigillose to velutinous-tomentulose usually becoming glabrescent. Petiole stout, 1.5–5 cm, densely strigillose or velutinous; leaf blade drying thinly to stiffly papery, broadly obovate or broadly elliptic, 11–20 × 8–18 cm, adaxially glabrescent, usually shiny, and often rugulose, abaxially densely tomentulose or strigillose to glabrescent, base obtuse, rounded, subcordate, or shortly cordate, apex obtuse or rounded sometimes with a short tip 3–5 mm; secondary veins 7–11 pairs, weakly but regularly looping to connect; stipules ovate or lanceolate, 6–11 mm, moderately to densely strigillose to strigose sometimes becoming glabrescent, obtuse to rounded. Inflorescences produced in with or often below leaves, subcapitate to congested-cymose, densely velutinous-tomentulose; peduncles 3–12 cm; branched portion 1.5–3 × 2–3.5 cm, axes scorpioid; bracts ovate, 5–7 mm, cadu-

cous. Flowers sessile. Calyx densely velutinous-tomentulose to strigillose; ovary portion obconic to cupulate, 2–2.5 mm; limb tubular, 2–3.5 mm, truncate. Corolla white, outside densely velutinous-tomentulose to strigillose; tube 2.5–3 cm, inside glabrous except sericeous in throat; lobes 7 or 8, obovate, 8–10 mm, obtuse to rounded. Drupes apparently green at maturity, oblate, 2–3 cm in diam., sparsely strigillose or tomentulose to eventually glabrescent; pyrene included in fibrous mesocarp. Fl. Apr–Jul.

Thickets on sandy and limestone coasts; sea level to near sea level. Guangdong, Hainan, Taiwan [Borneo, India, Indonesia, Japan, Malaysia, Philippines, Singapore, Sri Lanka, Thailand; coastal E Africa, Australia, Madagascar, Pacific islands].

The flowers are nocturnal and open for only one night (Puff et al., Rubiaceae of Thailand, 130. 2005). The fruit of this species float and are dispersed by water, and apparently they are green when mature. This species is known to be distylous in Polynesia and E Africa (Bridson & Verdcourt, Fl. Trop. E. Africa, Rub. (Pt. 2), 416. 1988).

### 32. GUIHAIOTHAMNUS H. S. Lo, Bull. Bot. Res., Harbin 18: 279. 1998.

桂海木属 gui hai mu shu

Chen Tao (陈涛); Charlotte M. Taylor

Subshrubs, unarmed; roots woody and stout. Raphides presumably absent. Leaves opposite, often congested or apparently fascicled at stem apices, without domatia; stipules caducous, apparently interpetiolar, triangular. Inflorescences terminal or pseudoaxillary, congested-cymose or subcapitate, several flowered, sessile to shortly pedunculate, bracteate with bracts linear. Flowers shortly pedicellate or subsessile, presumably bisexual, with biology unknown. Calyx limb deeply 5-lobed. Corolla pink, salverform with tube slender and abruptly expanded in throat, inside pubescent; lobes 5, convolute in bud. Stamens 5, inserted in corolla throat, partially exserted; filaments short to reduced. Ovary 2-celled, ovules numerous in each cell on fleshy, peltate, axile placentas; stigma

2-lobed with lobes capitate, exserted. Fruit purplish red, baccate, fleshy, subglobose, with calyx lobes tardily deciduous; seeds numerous, small, angled, reticulate.

- One species: China.

The relationships of this genus and some of its morphological details are unknown. The presence or absence of raphides has not been explicitly noted; absence is here inferred based on H. S. Lo's (in FRPS 71(1): ix. 1999) classification of this genus in Rondeletieae, but the one specimen seen has scattered raphidelike structures deep within some intact tissues.

**1. Guihaiothamnus acaulis** H. S. Lo, Bull. Bot. Res., Harbin 18: 280. 1998.

桂海木 *gui hai mu*

Plants 3–7 cm tall; stems quadrangular, densely villosulous, becoming glabrescent. Petiole 5–20 mm, villosulous; leaf blade drying papery and grayish brown, broadly elliptic-oblong to obovate, 4.5–11 × 2.5–7.5 cm, villosulous on both surfaces or glabrescent adaxially, base cuneate to truncate and often shortly decurrent, apex rounded or broadly obtuse and shortly cuspidate; secondary veins 8–12 pairs, slender; stipules 1–2

mm, obtuse and partially reflexed. Inflorescences densely villosulous; bracts 1.5–1.7 mm. Calyx pilosulous, villosulous, or glabrous; hypanthium portion obovoid-ellipsoid, ca. 1.7 mm; lobes linear-lanceolate to narrowly triangular, 1.7–2 mm, acute to acuminate. Corolla pale red, glabrous outside; tube ca. 19 mm, ca. 1 mm in diam. at base, 3–3.5 mm in diam. at throat, sparsely villous inside; lobes elliptic or ovate-elliptic, ca. 3 mm, rounded. Fruit purplish red, 2.5–3 mm in diam.; seeds 0.2–0.3 mm. Fl. Apr, fr. Jul.

- Shady rocks; 100–600 m. Guangxi (Rongshui).

### 33. HALDINA Ridsdale, Blumea 24: 360. 1979.

心叶木属 *xin ye mu shu*

Chen Tao (陈涛); Charlotte M. Taylor

Large trees, unarmed; buds flattened with stipules erect and pressed to each other. Raphides absent. Leaves opposite, decussate, with domatia; stipules caducous, interpetiolar, ovate to oblong, entire. Inflorescences axillary, capitate with 1 or 2(–5) fasciculate globose heads, many flowered, pedunculate, bracteate; peduncles articulate and bracteate near top; bracteoles spatulate to spatulate-clavate. Flowers sessile, bisexual, monomorphic. Calyx limb 5-lobed. Corolla pale to dark yellow, salverform, glabrous inside; lobes 5, imbricate in bud. Stamens 5, inserted in upper part of corolla tube, partially exserted; filaments reduced; anthers basifixed. Ovary 2-celled, ovules numerous in each cell, pendulous on axile placentas attached to upper third of septum; stigma ovoid to subglobose, exserted. Fruiting heads globose, with fruit rather tightly packed. Fruit capsular, obconic to ellipsoid-oblong, septicidally then loculicidally dehiscent into 2 valves separating from base to apex and from persistent septum, cartilaginous to stiffly papery, with calyx limb persistent on persistent septum; seeds numerous, medium-sized, ovoid to fusiform, slightly flattened, shortly winged on ends.

One species: Cambodia, China, India, Nepal, Sri Lanka, Thailand, Vietnam.

Ridsdale (loc. cit.) and Puff et al. (Rubiaceae of Thailand, 52. 2005) described the aestivation of the corolla lobes as, respectively, “valvate but strongly imbricate at apex” and “valvate in bud (but strongly imbricate at the apex)”; they also both describe the fruit as separating into 4 valves, but only 2 valves have been seen on the specimens studied.

**1. Haldina cordifolia** (Roxburgh) Ridsdale, Blumea 24: 361. 1979.

心叶木 *xin ye mu*

*Nauclea cordifolia* Roxburgh, Pl. Coromandel 1: 40. 1795;  
*Adina cordifolia* (Roxburgh) J. D. Hooker ex B. D. Jackson.

Trees, deciduous, 7–30(–40) m tall; trunk often buttressed and fluted at base, with outer bark reddish brown, inner bark dark red to brown; branches stout, with well-developed petiole scars. Petiole 2–12 cm, densely tomentulose to pilosulous; leaf blade drying thinly leathery, brown adaxially, and pale to yellowish green abaxially, broadly ovate, (5–)8–16(–25) × (5–)8–16(–20) cm, adaxially sparsely hirtellous to puberulent or glabrescent, abaxially densely puberulent, tomentulose, pilosulous, or glabrescent and with epidermis bullate inside areoles of quaternary veins, base cordate, apex acute to acuminate; secondary veins 6–10 pairs, usually divaricately branched half way along

their length, sometimes with pilosulous domatia; stipules spatulate, ovate, or oblong-oblong, 10–12 × 5–12 mm, usually strongly keeled, densely strigillose to pilosulous, broadly rounded. Inflorescence densely tomentulose to pilosulous; peduncle 2–6(–10) cm, at articulation with 2 bracts 1–2 mm, broadly rounded; flowering heads 5–8 mm in diam. across calyces, ca. 20 mm in diam. across corollas; bracteoles linear to clavate, ca. 2 mm. Calyx densely strigillose; ovary portion 1–2 mm, densely sericeous, surrounded at base by a dense ring of trichomes 1–2 mm; limb deeply lobed, lobes narrowly triangular to linear, 1.3–1.8 mm, at apex clavate. Corolla outside densely strigillose; tube 5–6 mm; lobes elliptic-oblong, 1–2 mm, obtuse to rounded. Stigma ovoid, ca. 0.2 mm, exserted for 5–7 mm. Fruiting heads 10–15 mm in diam. Capsules 4–5 mm, densely strigillose or glabrescent near base; seeds 2–3.5 × 0.5–1 mm. Fl. spring and summer.

Tropical rain forests; 300–1000 m. Yunnan [Cambodia, India, Nepal, Sri Lanka, Thailand, Vietnam].

**34. HAMELIA** Jacquin, Enum. Syst. Pl. 2, 16. 1760.长隔木属 *chang ge mu shu*

Chen Tao (陈涛); Charlotte M. Taylor

*Duhamelia* Persoon; *Tangaraca* Adanson.

Shrubs, unarmed. Raphides absent. Leaves opposite or verticillate, usually with domatia; stipules persistent, interpetiolar, triangular. Inflorescences terminal, cymose with axes often helicoid and secund, many flowered, bracteate or bracts reduced. Flowers sessile to pedicellate, bisexual, monomorphic. Calyx limb 5-lobed. Corolla red to orange or yellow, tubular [to ventricose or funnel-form], glabrous inside; lobes 5, imbricate in bud. Stamens 5, inserted at base of corolla tube, included or partially exerted; filaments short; anthers dorsifixed, 2-lobed at base, with connective flattened and prolonged at apex. Ovary 5-celled, ovules numerous in each cell on axile placentas; stigmas 1–5, linear to clavate, included or exerted. Fruit becoming red then purple-black, baccate, fleshy to juicy, ellipsoid to ovoid or subglobose, with calyx limb persistent; seeds numerous, small, irregularly angled to lenticular; testa membranous, reticulate.

Sixteen species: neotropical, from S United States and Mexico to Argentina; one species (introduced) in China.

H. S. Lo (in FRPS 71(1): 388. 1999) described the flower arrangement with short pedicels or subsessile, but the structures interpreted there as pedicels are considered by one of us (C. M. Taylor) and by some other authors to be inflorescence axes and the flowers thus are sessile. Lo described the stipules as multifid or bristlelike, but this condition is not otherwise known from the genus and has not been seen on any Chinese specimens. He gave the number of calyx lobes, corolla lobes, and stamens as 4–6, but this has not been seen; these structures are 5 in all *Hamelia* species known. The corollas were described as villous in throat, but all known species of *Hamelia* have corollas that are glabrous inside; as well, the corolla was described as campanulate in shape, but the cultivated species has rather narrowly tubular flowers. The anthers were described as basifixed and entire at base, but other authors all found them dorsifixed and sagittate at base.

**1. *Hamelia patens*** Jacquin, Enum. Syst. Pl. 16. 1760.长隔木 *chang ge mu*

Shrubs, deciduous, 1.5–4 m tall; branches angled to subterete, often becoming red, hirtellous or pilosulous to glabrescent. Leaves 2, 3, or 4 (or 5) per node; petiole 1.5–4.5 cm, pilosulous or hirtellous to glabrous; blade drying papery to membranous, elliptic to oblanceolate, 7–20 × 4–6 cm, both surfaces pilosulous or hirtellous to glabrescent, base cuneate to acute, apex acute to weakly acuminate; secondary veins 7–9 pairs, in abaxial axils frequently with pilosulous domatia; stipules narrowly triangular to subulate, 2–6 mm, hirtellous or pilosulous to glabrescent. Inflorescences corymbiform, villosulous or pilosulous to glabrescent; peduncle 1–8 cm; branched portion corymbiform, 1.5–7 × 1.5–9 cm; bracts reduced or tri-

angular, 0.2–0.5 mm. Flowers subsessile to pedicellate; pedicels to 2 mm. Calyx hirtellous to glabrous; ovary portion ellipsoid, ca. 3 mm; limb deeply lobed; lobes triangular, 0.8–1 mm. Corolla red to red-orange or yellow, narrowly tubular, outside puberulent to glabrous; tube smooth to shallowly 5-ribbed, 16–23 mm; lobes ovate-triangular, 1–2 mm, acute. Berry ovoid, 6–7 mm in diam., puberulent to glabrescent. Fl. May–Dec.

Cultivated in gardens in Fujian, Yunnan [native and weedy in Mexico, United States (Florida), and the Caribbean region, Central America, and tropical South America; cultivated as a perennial in tropical regions and an annual or indoors in temperate regions worldwide].

In S China and in cultivation in general this species does not set fruit; the fruit description here is based on wild plants. The flowers of the cultivated plants range from yellow to dark scarlet red, and in recent years many new cultivars have been developed.

**35. HEDYOTIS** Linnaeus, Sp. Pl. 1: 101. 1753, nom. cons.耳草属 *er cao shu*

Chen Tao (陈涛); Charlotte M. Taylor

*Diplophragma* (Wight & Arnott) Meisner; *Exallage* Bremekamp; *Gonothea* Blume ex Candolle (1830), not Rafinesque (1818); *Hedyotis* sect. *Diplophragma* Wight & Arnott; *Metabolos* Blume; *Oldenlandia* Linnaeus; *Thecagonum* Babu.

Herbs, subshrubs, or shrubs, annual or perennial, procumbent to erect or climbing, unarmed. Raphides present. Leaves opposite [or rarely whorled], sometimes clustered at ends of stems, without domatia; secondary venation rarely triplinerved or palmate; stipules persistent, interpetiolar, fused to petiole bases, or united around stem, triangular to truncate, entire or ciliate to lacinate, erose, 1- to several lobed and/or -setose. Inflorescences terminal, pseudoaxillary, and/or axillary, few to many flowered and fasciculate, cymose, paniculate, capitate, or glomerulate or reduced to 1 flower, sessile or pedunculate, bracteate or bracts reduced. Flowers pedicellate or sessile, bisexual and monomorphic or distylous [to unisexual on dioecious plants]. Calyx limb shallowly to deeply (2–)4-lobed (or 5-lobed, *Hedyotis hainanensis*). Corolla white, pink, purple, or blue, tubular, funnellform, salverform, rotate, or urceolate, variously glabrous or pubescent inside; lobes (2–)4 (or 5, *H. hainanensis*), valvate in bud. Stamens 4 (or 5, *H. hainanensis*), inserted in corolla tube or throat, included or exerted; filaments developed to reduced; anthers dorsifixed often near base. Ovary 2-celled, ovules few to numerous or rarely 1 in each cell on axile placentas; stigma 2-lobed with lobes linear to clavate or rarely undivided, included or exerted. Fruit indehiscent, schizocarpous, or capsular, generally subglobose to ovoid or dicocous, crusta-

ceous to membranous or leathery, when schizocarpous splitting into 2 mericarps, when capsular splitting partially to entirely septically and/or loculicidally, subsequently sometimes splitting other way, apically flattened or with short to well-developed beak (i.e., disk area inside calyx limb), sometimes dehiscent primarily through beak, with calyx limb persistent; seeds few to numerous, small, angular or plano-convex; testa smooth, reticulate, or otherwise variously ornamented; endosperm fleshy; radicle clavate or terete.

About 500 species: tropical and subtropical regions worldwide, most in Africa and Asia, a few in warm temperate regions; 67 species (38 endemic) in China.

This is a very problematic genus or group of genera. Neither the overall identity and limits of this lineage—distributed throughout the tropics and warm temperate regions of the world, with numerous species with often reduced morphology—nor the evolutionary patterns within it are at all understood or delineated. Widely differing taxonomies and species-level characters have long been used in different regions and floras. It is generally accepted now that *Hedyotis* is closely related to or at least in some cases perhaps includes *Houstonia* Linnaeus, *Kadua* Chamisso & Schlechtendal, *Kohautia* Chamisso & Schlechtendal, *Neanotis*, *Oldenlandia*, and a number of smaller segregate genera including *Exallage*, *Oldenlandiopsis* Terrell & W. H. Lewis, *Pentodon* Hochstetter, *Stenaria* Terrell, *Stenotis* Terrell, and *Thecagonum*. The situation is far from resolution or even general consensus. This genus is treated broadly here, as done also by many recent authors working our flora region (Fukuoka, S. E. Asia Stud. 8(3): 305–336. 1970; W. C. Ko in FRPS 71(1): 26–77. 1999; Wang & Zhao, J. Trop. Subtrop. Bot. 9(3): 219–228. 2001; Dutta & Deb, Taxon. Rev. *Hedyotis*. 2004). Recently, some authors have separated *Oldenlandia*; but, as outlined by Terrell and Robinson (Taxon 52: 775–782. 2003), recent molecular studies have concluded that the circumscriptions and relationships of these two groups are less well understood than had been thought, and these groups are probably paraphyletic and/or polyphyletic with relation to each other as well as several other genera.

The taxonomy of *Hedyotis* is further complicated by nomenclatural issues, in particular the designation of the type species. Dutta and Deb (loc. cit. 2004 – a late publication of a 1991 manuscript), following majority opinion of the time, considered *H. auricularia* as the type of *Hedyotis*; however, subsequently, *H. fruticosa* Linnaeus instead was successfully proposed as the conserved type of the genus (Nicolson, Taxon 41: 564. 1992; see *Vienna Code*, App. III, p. 343). The typification of *Hedyotis* and corresponding generic names were reviewed in detail by Terrell and Robinson (loc. cit.).

Terrell and Robinson (loc. cit.) also summarized the infrageneric classification and species groups of *Hedyotis*, including those accepted by W. C. Ko (loc. cit.), but without noting a few differences between Ko's classifications and theirs, nor the use of some incorrect sectional names by Ko (e.g., *H. sect. "Euoldenlandia"* would have been called *H. sect. "Oldenlandia"* if it had been published, but it was not; Ko's *H. sect. "Diplophragma"* included the species that is now the type of the genus, thus this should have been called *H. sect. Hedyotis*, while this particular section was synonymized by Terrell & Robinson). The genus circumscription as well as the infrageneric classification of *Hedyotis* are very far from understood at present (Groeninckx et al., Scripta Bot. Belg. 44: 33. 2008).

The information available about *Hedyotis bodinieri* is inadequate to include this species in the key. Because of the complexity of this genus or group of genera and the large number of species in China, the descriptions here are more detailed than in some other Rubiaceae genus treatments here. W. C. Ko (loc. cit.) described the fruit of most species of *Hedyotis* as dehiscent into 2 mericarps at maturity, with mericarps vertically dehiscent at ventral part, but these fruit are considered capsules by other authors. In some cases, this description was not entirely accurate because the fruit are actually truly schizocarpous (i.e., with indehiscent mericarps) or primarily loculicidal.

- 1a. Stems pilose, hirsute, tomentose, or villous and sometimes also hirtellous or villosulous, with pubescence sparsely to densely distributed and with some trichomes 1 mm or more.
  - 2a. Plants scandent, climbing, or clambering; inflorescences terminal and in uppermost leaf axils, sometimes on very short lateral stems.
    - 3a. Inflorescences cymose, corymbiform-rounded; flowers all pedicellate, pedicels 1.5–3 mm ..... 42. *H. obliquinervis*
    - 3b. Inflorescences capitate, subcapitate, glomerulate, subglobose, or hemispherical; flowers sessile or subsessile.
      - 4a. Heads solitary on peduncles or glomerulate along stem and/or along peduncles ..... 24. *H. dianxiensis*
      - 4b. Heads several in paniculate groups on each or at least most peduncles ..... 13. *H. capitellata*
  - 2b. Plants prostrate on ground, erect, or climbing; inflorescences terminal and/or axillary along middle or lower stem nodes.
    - 5a. Stipules entire; inflorescences and flowers sessile; Hainan, Taiwan.
      - 6a. Annual herbs to 30 cm tall; calyx lobes ca. 1.5 mm; Taiwan ..... 11. *H. butensis*
      - 6b. Perennial subshrubs or shrubs to 1 m tall; calyx lobes 2.5–3 mm; Hainan ..... 64. *H. wuzhishanensis*
    - 5b. Stipules erose or 2–5-lobed or -setose; inflorescences and flowers sessile to pedicellate and/or pedunculate; mainland and Hainan.
      - 7a. Low annual herbs, prostrate to weakly erect; leaves 6–10 mm wide; flowers few or solitary, subsessile to pedicellate; Hainan ..... 58. *H. trinervia*
      - 7b. Annual or perennial herbs or subshrubs, generally erect and robust; leaves 5–45 mm wide; flowers several to numerous, sessile to pedicellate in pedunculate heads or cymes.
        - 8a. Flowers subsessile to pedicellate; glomerules or cymes subsessile to pedunculate; calyx lobes 1–1.2 mm ..... 34. *H. lineata*
        - 8b. Flowers sessile or subsessile; cymes or heads pedunculate; calyx lobes 0.3–1 mm ..... 62. *H. vestita*
  - 1b. Stems glabrous to puberulent, strigillose, hispidulous, strigose, hirtellous, or pilosulous and sometimes hirsute or pilose in small scattered patches or lines, with trichomes generally all less than 1 mm.

- 9a. Inflorescences mostly or all axillary or pseudoaxillary; stem apices generally vegetative.
- 10a. Inflorescences capitate, cymose, paniculate, fasciculate, or glomerulate, subsessile or on developed peduncles.
- 11a. Bracts lanceolate, ovate, elliptic, or broadly triangular, 1–12 mm, partly to fully enclosing flowers; flowers sessile to shortly pedicellate in heads or congested or somewhat lax cymes, or on pedicels to 1.5 mm; stipules triangular, 4–13 mm.
- 12a. Inflorescences congested-cymose to shortly paniculate or subglomerulate, sessile to pedunculate, peduncle to 2 cm; leaves 15–25 × 3–6 cm ..... 15. *H. cathayana*
- 12b. Inflorescences capitate or glomerulate to laxly cymose, subsessile to pedunculate, peduncle to 8 cm; leaves 12–17 × 0.5–4 cm.
- 13a. Inflorescences capitate or glomerulate, on well-developed peduncles 2.5–7 cm ..... 9. *H. bracteosa*
- 13b. Inflorescences cymose, branched, on peduncles 0.5–8 cm.
- 14a. Stipules 1.5–5 mm; calyx lobes 0.8–1.2 mm; corolla tube 2.2–3.5 mm ..... 1. *H. acutangula*
- 14b. Stipules 8–13 mm; calyx lobes 2–3 mm; corolla tube 4.5–5 mm ..... 20. *H. communis*
- 11b. Bracts reduced, absent, or narrow to triangular, 1–5 mm, not enclosing flowers; flowers separately pedicellate and/or pedunculate, solitary or in lax cymes; pedicels 1–30 mm; stipules reduced or triangular to truncate, 0.3–3 mm.
- 15a. Flowers several (i.e., ca. 5) to many in terminal and axillary lax cymes or panicles, separately pedicellate with pedicels 1–15 mm; leaves 7–35 mm wide.
- 16a. Pedicels 4–15 mm; stipules triangular, ovate, or subtruncate, entire or glandular-serrulate or glandular-erose ..... 55. *H. tenuipes*
- 16b. Pedicels 1–3 mm; stipules entire, 4–6-lobed, -setose, and/or ciliolate.
- 17a. Stipules 4–6-lobed or -setose ..... 3. *H. assimilis*
- 17b. Stipules entire or ciliolate ..... 35. *H. loganioides*
- 15b. Flowers 1–5 per axil, all axillary on separate peduncles or in pedunculate cymes, pedicels and peduncles 1–30 mm; leaves 1–5 mm wide.
- 18a. Capsule with developed beak 1–1.5 mm, conical, longer than calyx lobes; stipules reduced, sheath portion reduced to a line or up to 0.3 mm; corolla tube 2–3 mm and lobes 0.5–1 mm ..... 30. *H. herbacea*
- 18b. Capsule flat on top or with beak rounded to broadly angled, up to 0.5 mm, shorter than or equal to calyx lobes; stipules with sheath tubular to triangular, 0.5–2 mm; corolla tube 0.8–2.5 mm and lobes 0.8–1.5 mm.
- 19a. Stems quadrate to flattened with angles thickened to winged and usually pubescent to scaberulous; flowers 1–5 per peduncle, all pedicellate; stigmas and anthers included ..... 22. *H. corymbosa*
- 19b. Stems terete to flattened or 4-angled when young, glabrous to rather evenly scaberulous or pubescent; flowers 1 or 2 in each stem axil, subsessile to pedicellate; stigmas and anthers exerted.
- 20a. Stems glabrous; peduncles and/or pedicels to 3 mm in flower, to 8 mm in fruit ..... 8. *H. brachypoda*
- 20b. Stems puberulent and/or scaberulous; peduncles 4–20 mm ..... 25. *H. diffusa*
- 10b. Inflorescences sessile or subsessile, unbranched, i.e., glomerulate, capitate, congested-cymose, subcapitate, shortly fasciculate, or 1-flowered.
- 21a. Stipules at flowering nodes with sheath 3–30 mm and these and/or leaf bases partially to fully enclosing and mostly hiding inflorescences.
- 22a. Leaves 15–30 × 5–10 cm; stipules narrowly triangular, 8–30 mm; calyx lobes 6–8 mm; corolla tube 14–16 mm; Hainan ..... 23. *H. cryptantha*
- 22b. Leaves 2.5–12 × 1–4 cm; stipules broadly triangular to obovate, 3–10 mm; calyx lobes 1.5–6 mm; corolla tube 1.8–12 mm; mainland and Hainan.
- 23a. Calyx lobes 1.5–3 mm; corolla tube 1.8–2 mm ..... 33. *H. lianshanensis*
- 23b. Calyx lobes 2–6 mm; corolla tube 6–12 mm.
- 24a. Leaves rounded to obtuse at base and sessile or subsessile; inflorescence terminal and pseudoaxillary; calyx lobes widest above middle ..... 40. *H. merguensis*
- 24b. Leaves rounded to acute at base and petiolate, petioles 3–18 mm; inflorescences axillary; calyx lobes widest at or below middle ..... 47. *H. platystipula*
- 21b. Stipules with sheath 4 mm or shorter (measured from line between bases of petioles), neither these nor leaf bases enclosing inflorescence.
- 25a. Leaves linear, narrowly elliptic, narrowly spatulate, linear-lanceolate, or narrowly elliptic-oblong, 0.8–13 mm wide, with margins mostly straight, with secondary veins not visible.
- 26a. Fruit compressed globose or subglobose; calyx lobes 1–1.5 mm; flowers solitary or 2 per node, pseudoaxillary ..... 8. *H. brachypoda*
- 26b. Fruit ovoid to lanceoloid; calyx lobes 1–2.5 mm; flowers 1 to several per node, axillary, pseudoaxillary, and/or sometimes terminal.

- 27a. Inflorescences terminal and pseudoaxillary on short axillary stems; leaves linear to narrowly spatulate, 0.8–2 mm wide ..... 46. *H. pinifolia*
- 27b. Inflorescences all axillary; leaves narrowly elliptic to linear, 1.5–13 mm wide.
- 28a. Calyx glabrous; flowers 1–3 per node; leaves 1.5–4 mm wide ..... 54. *H. tenelliflora*
- 28b. Calyx densely hispidulous; flowers several per node; leaves 3–13 mm wide ..... 61. *H. verticillata*
- 25b. Leaves narrowly to broadly elliptic, lanceolate, ovate, or elliptic-oblong, 4–45 mm wide, with margins curved, with secondary veins visible or not.
- 29a. Plants prostrate, regularly rooting at nodes; leaves 0.8–3.2 × 0.5–1.4 cm; flowers few, subsessile to pedicellate ..... 19. *H. chrysostricha*
- 29b. Plants erect to procumbent, clambering, or prostrate, rooting only at or near base; leaves 1.2–12 × 0.3–4.5 cm; flowers few to numerous, sessile to pedicellate.
- 30a. Calyx lobes 1.5–4 mm.
- 31a. Fruit indehiscent; inflorescences all produced at nodes below apex; corolla 3–4.5 mm ..... 33. *H. lianshanensis*
- 31b. Fruit dehiscent septicidally then loculicidally; inflorescences terminal and axillary at uppermost stem nodes; corolla 4.5–5.5 mm ..... 59. *H. uncinella*
- 30b. Calyx lobes 0.8–1.5 mm.
- 32a. Leaves 1.2–4.5 cm wide, with secondary veins hardly or not visible; inflorescences axillary at upper nodes and often also terminal; corolla 3–4.2 mm ..... 48. *H. prostrata*
- 32b. Leaves 0.3–3 cm wide, with secondary veins clearly evident; inflorescences at apex and/or nodes below apex; corolla 1–2.5 mm.
- 33a. Leaves subsessile to petiolate, 0.4–3 cm wide; stipules densely setose; inflorescences at nodes well below stem apex; corolla lobes 0.5–1 mm; widespread ..... 4. *H. auricularia*
- 33b. Leaves sessile, 0.3–1 cm wide; stipules entire; inflorescences terminal and at uppermost nodes; corolla lobes ca. 0.2 mm; N Taiwan ..... 11. *H. butensis*
- 9b. Inflorescences terminal, or terminal and in uppermost leaf axils.
- 34a. Flowers 5-merous; calyx lobes 3–3.5 mm ..... 28. *H. hainanensis*
- 34b. Flowers 4-merous; calyx lobes 0.1–35 mm.
- 35a. Leaves linear, linear-lanceolate, narrowly elliptic, narrowly lanceolate, narrowly spatulate, or narrowly elliptic-oblong, consistently 0.8–5.5 mm wide.
- 36a. Flowers 2–12 in lax cymes; pedicels 3–20 mm ..... 32. *H. koana*
- 36b. Flowers 3 to numerous in heads, fascicles, or congested to lax cymes; flowers sessile or on pedicels to 3 mm.
- 37a. Inflorescences with axes regularly dichotomous, 4–13 cm, with numerous flowers ..... 57. *H. tetragularis*
- 37b. Inflorescences up to 3 cm, capitate to cymose, with several flowers.
- 38a. Flowers on pedicels 0.5–1.2 mm; corolla tube 1.5–2.2 mm ..... 10. *H. brevicalyx*
- 38b. Flowers sessile or on pedicels to 1 mm; corolla tube 3–4.2 mm ..... 46. *H. pinifolia*
- 35b. Leaves variously shaped, linear to elliptic, lanceolate, elliptic-oblong, or ovate, 3–120 mm wide with at least some leaves more than 5 mm wide.
- 39a. Inflorescences 1-flowered or capitate, subcapitate, fascicled, or congested-cymose, with flowers few to numerous and sessile to subsessile or shortly pedicellate, in heads or congested to lax cymes.
- 40a. Flowers solitary or 2–5 and fasciculate to very shortly cymose, sessile to shortly pedicellate; leaves 0.8–7 × 0.5–3.5 cm.
- 41a. Calyx lobes ca. 4 mm, longer than or ± as long as corolla tube ..... 43. *H. ovata*
- 41b. Calyx lobes 3–3.5 mm, much shorter than corolla tube ..... 50. *H. pulcherrima*
- 40b. Flowers 4 to numerous, sessile to shortly pedicellate in heads, congested cymes, or umbelliform cymes; leaves 1–12 × 0.6–4.5 cm.
- 42a. Inflorescences with peduncles, with 1 to several heads, with subtending bracts developed to leaflike or reduced.
- 43a. Calyx lobes 3–6 mm.
- 44a. Leaves 4–5.5 × 0.6–2.6 cm ..... 65. *H. xanthochroa*
- 44b. Leaves (at least well-developed ones) 8–12 × 3–4.5 cm ..... 66. *H. yangchunensis*
- 43b. Calyx lobes 0.3–4 mm.
- 45a. Corolla tube ca. 7 mm; inflorescence with 1 congested-cymose head (as far as known); flowers sessile ..... 63. *H. wangii*
- 45b. Corolla tube 1–3 mm; inflorescence (at least usually) with 2–15 heads; flowers sessile or subsessile.
- 46a. Plants erect; corolla lobes shorter than tube, tube ca. 3 mm and lobes ca. 1.3 mm ..... 14. *H. capituligera*
- 46b. Plants clambering to climbing; corolla lobes longer than tube, tube 1–2 mm and lobes 3–5 mm.

- 47a. Stems and leaves glabrescent or hirtellous, pilosulous, hispidulous, or tomentulose; calyx limb lobed for 1/3–3/4 ..... 13. *H. capitellata*
- 47b. Stems and leaves densely tomentulose or villous to glabrous; calyx limb deeply lobed ... 24. *H. dianxiensis*
- 42b. Inflorescences sessile or subsessile, in 1 head subtended by leaves or well developed to leaflike bracts.
- 48a. Calyx lobes ca. 35 mm; leaves 4–12 cm wide ..... 67. *H. yazhouensis*
- 48b. Calyx lobes 1–5.5 mm; leaves 0.4–6 cm wide.
- 49a. Leaves with petioles 10–15 mm ..... 5. *H. baotingensis*
- 49b. Leaves sessile or with petioles to 10 mm, at least some shorter than 10 mm.
- 50a. Calyx lobes 1–1.2 mm; corolla tube 2–3 mm ..... 48. *H. prostrata*
- 50b. Calyx lobes 2–5.5 mm; corolla tube 3–12 mm.
- 51a. Corolla tube 9–12 mm ..... 40. *H. merguensis*
- 51b. Corolla tube 3–6.5 mm.
- 52a. Stipules acute or aristate.
- 53a. Leaves 0.4–1.2 cm wide, with petioles to 3 mm ..... 37. *H. longipetala*
- 53b. Leaves 1.4–4.5 cm wide, with petioles to 10 mm.
- 54a. Stems glabrous; leaves 7–12 cm; corolla tube 4–5 mm ..... 45. *H. paridifolia*
- 54b. Stems densely villous to hirtellous; leaves 2.5–6.2 cm; corolla tube 5.5–6.5 mm ..... 64. *H. wuzhishanensis*
- 52b. Stipules lacinate or with several lobes or bristles.
- 55a. Leaves puberulent to glabrous adaxially; flowers sessile or subsessile; corolla lobes 1.5–2 mm; fruit 1.8–2 mm in diam. .... 59. *H. uncinella*
- 55b. Leaves glabrous or glabrescent adaxially; flowers sessile or on pedicels to 2 mm; corolla lobes 2–2.5 mm; fruit 2–2.5 mm in diam.
- 56a. Corolla tube ca. 5 mm; fruit ca. 2 mm in diam. .... 17. *H. cheniana*
- 56b. Corolla tube ca. 3.5 mm; fruit ca. 2.5 mm in diam. .... 56. *H. terminaliflora*
- 39b. Inflorescences branched, cymose to paniculate, with flowers few to numerous, at least some of them regularly pedicellate (or separated on well-developed inflorescence axes).
- 57a. Plants low annuals or perennials, vegetative part (and usually entire plant) mostly up to 15 cm tall, sometimes to 40 cm tall, often weak or scapose, often quite succulent; flowers few to numerous in small to diffuse cymes.
- 58a. Leaves usually clustered at top of stem (i.e., at base of inflorescence) due to reduced internodes and appearing verticillate; stems densely pilosulous, puberulent, or villosulous and often glandular on uppermost nodes ..... 44. *H. ovatifolia*
- 58b. Leaves generally distributed along stem in pairs, or entire stem with reduced internodes; stems glabrous to variously pubescent, not glandular.
- 59a. Hypanthium and fruit 4-winged, wings usually extending downward along pedicel ..... 49. *H. pterita*
- 59b. Hypanthium and fruit smooth or with low ridges, or hypanthium sometimes narrowly winged in flower but becoming smooth as fruit develops.
- 60a. Calyx lobes ovate, relatively broad, sometimes with evident venation ..... 31. *H. hermanniana*
- 60b. Calyx lobes triangular to lanceolate, generally narrow, not veined.
- 61a. Calyx limb lobed essentially to base, with tubular portion reduced or just a line; fruit with beak mostly as long as or longer than calyx lobes; plants not or somewhat succulent, weedy in various habitats ..... 6. *H. biflora*
- 61b. Calyx limb with tube developed, lobed for 1/2–2/3, remaining developed and connected to lobes in fruit; fruit with beak much shorter than calyx lobes; plants succulent, mostly on seashores and rocks at low elevations ..... 53. *H. strigulosa*
- 57b. Plants small to large, apparently perennials, vegetative portion usually at least 20 cm tall, robust, erect to clambering or climbing, usually not scapose, not or sometimes slightly succulent; flowers several to numerous in congested to expanded cymes or panicles.
- 62a. Plants clambering, scandent, lianescent, or climbing.
- 63a. Leaves with secondary veins plane and generally not evident abaxially ..... 51. *H. scandens*
- 63b. Leaves with secondary veins plane to prominulous and evident abaxially.
- 64a. Flowers pedicellate in dichotomous cymules, with pedicels 1–3.5 mm; axes and pedicels of inflorescence generally spreading at 60°–90° ..... 2. *H. ampliflora*
- 64b. Flowers sessile to subsessile or pedicellate in congested to subcapitate cymules, with pedicels to 2 mm; axes and pedicels of inflorescence generally ascending, at angles less than 60°.

- 65a. Stems densely villous and/or tomentulose; flowers in distinct, discrete heads; calyx lobes generally erect ..... 24. *H. dianxiensis*
- 65b. Stems glabrous to papillose, pilosulous, or velutinous-strigillose; inflorescence at least partly cymose; calyx lobes spreading to usually reflexed ..... 29. *H. hedyotidea*
- 62b. Plants erect.
- 66a. Flowers all pedicellate, pedicels 4–15 mm.
- 67a. Calyx lobes 0.1–0.3 mm; corolla 1–1.5 mm ..... 18. *H. cherevensis*
- 67b. Calyx lobes 1–1.5 mm; corolla 4.5–7 mm ..... 55. *H. tenuipes*
- 66b. Flowers sessile to subsessile, mixed sessile and pedicellate, or all pedicellate, pedicels to 5 mm but most less than 4 mm.
- 68a. Inflorescence axes and pedicels spreading at 90° or more; leaves usually borne at only 2 or 3 stem nodes ..... 26. *H. effusa*
- 68b. Inflorescence axes and pedicels ascending to slightly spreading, generally at angles less than 60° (or frequently to 90° or more in *H. vachellii* in fruit); leaves borne at few to numerous stem nodes.
- 69a. Stipules setose, lobed, or lacinate, with 2 to several narrow lobes, awns, or bristles (at least on lower nodes).
- 70a. Corolla tube longer than corolla lobes; inflorescences with several subcapitate to congested-cymose heads or cymules.
- 71a. Flowers sessile to subsessile ..... 14. *H. capituligera*
- 71b. Flowers sessile and pedicellate, pedicels to 4 mm ..... 38. *H. matthewii*
- 70b. Corolla lobes longer than corolla tube; inflorescences with few- to many-flowered cymes; pedicels 1–5 mm.
- 72a. Stipules 4–6-lobed or -setose ..... 3. *H. assimilis*
- 72b. Stipules glandular-serrulate to 3-lobed or -setose ..... 39. *H. mellii*
- 69b. Stipules entire or sometimes with a terminal awn and/or serrate to serrulate-denticulate.
- 73a. Leaves with secondary veins prominulous and evident on abaxial surface ..... 39. *H. mellii*
- 73b. Leaves with secondary veins plane and generally not evident on abaxial surface.
- 74a. Stems sharply angled to winged, at least on lower internodes; leaves sessile, often clasping at base ..... 1. *H. acutangula*
- 74b. Stems rounded to flattened or angled, angles generally not sharp; leaves petiolate to subsessile, at base narrow to rounded but usually not clasping.
- 75a. Calyx lobes ca. 4 mm ..... 43. *H. ovata*
- 75b. Calyx lobes 0.3–2.5 mm.
- 76a. Plants scapose, with leaves clustered at base; leaves 5–9 cm wide ..... 52. *H. shenzhenensis*
- 76b. Plants with leaves distributed along stem; leaves 0.4–3.5 cm wide.
- 77a. Corolla tube 1.5–2.5 mm; calyx lobes 0.5–1.2 mm; inflorescence axes often becoming spiciform and/or scorpioid.
- 78a. Calyx lobes 0.8–1.2 mm; leaves with secondary veins 4–6 pairs ..... 21. *H. consanguinea*
- 78b. Calyx lobes ca. 0.5 mm; leaves with secondary veins ca. 3 pairs ..... 36. *H. longiexserta*
- 77b. Corolla tube 2.5–10 mm; calyx lobes 1–2.5 mm; inflorescence axes generally dichasial.
- 79a. Corolla with tube 4–10 mm, lobes 1/2 as long as tube or shorter.
- 80a. Corolla white or pink, with tube markedly funnelform ..... 16. *H. caudatifolia*
- 80b. Corolla pink to purple, with tube cylindrical to slightly funnelform.
- 81a. Corolla tube ca. 6 mm ..... 27. *H. exserta*
- 81b. Corolla tube 7–10 mm ..... 41. *H. minutopuberula*
- 79b. Corolla with tube 2.5–4 mm, lobes shorter than tube but more than 1/2 as long as tube.
- 82a. Pedicels to 4 mm; corolla tube 3.5–4 mm and lobes 2–3 mm ..... 38. *H. matthewii*
- 82b. Pedicels to 1.5 mm; corolla tube 2.5–3.5 mm and lobes 2–2.2 mm.
- 83a. Inflorescences narrowly cylindrical to pyramidal, axes ascending; fruit 2–3 mm in diam. .... 12. *H. cantoniensis*
- 83b. Inflorescences broadly pyramidal to rounded, axes ascending to spreading at 90° or more; fruit ca. 1.8 mm in diam. .... 60. *H. vachellii*

**1. *Hedyotis acutangula*** Champion ex Bentham, Hooker's J. Bot. Kew Gard. Misc. 4: 171. 1852.

金草 jin cao

*Oldenlandia acutangula* (Champion ex Bentham) Kuntze.

Herbs or subshrubs, apparently biennial or perennial, erect, 25–60 cm tall; stems sometimes slightly constricted at nodes, 4-

angled to 4-winged, wings to 1.5 mm wide. Leaves sessile or subsessile; blade drying stiffly papery to leathery, ovate-lanceolate, lanceolate, elliptic, or lanceolate-elliptic, 2–12 × 0.5–2.5 cm, glabrous, base cuneate to rounded, margins thickened, often inrolled, sometimes glandular-serrulate, apex acute or shortly acuminate; secondary veins indistinct; stipules fused to petiole bases, ovate or triangular, 1.5–5 mm, glabrous, margins often becoming revolute, entire or glandular-serrulate, apex acute to acuminate. Inflorescences terminal, in axils of uppermost leaves, and occasionally also axillary or pseudoaxillary at lower nodes, paniculate or corymbose, 3–20 cm, many flowered, glabrous, pedunculate; peduncle 2–8 cm; axes dichasial, sharply 4-angled to thinly 4-winged; bracts triangular to lanceolate and 0.3–5 mm, or leaflike and larger. Flowers sessile, distylous. Calyx glabrous; hypanthium portion turbinate to ellipsoid, 0.8–1 mm; limb lobed nearly to base; lobes ovate, triangular, or lanceolate, 0.8–1.2 mm. Corolla white to pink, funnellform, outside glabrous; tube 2.2–3.5 mm, inside tomentose above middle; lobes ovate-lanceolate, 2–3 mm. Anthers included or exerted, ca. 1 mm. Stigma included or exerted, 0.5–1 mm. Fruit capsular, obovoid to ellipsoid, 2–2.5 × 1–1.2 mm, glabrous, leathery, apically flat or with beak to 0.3 mm, septicial and then loculicidal along middle of septum; seeds several, black, suborbicular, angled. Fl. May–Dec, fr. Jun–Dec.

Hill slopes, open fields; near sea level to 600 m. Fujian, Guangdong, Hainan (Wanning) [N Thailand, Vietnam].

Deb and Dutta (Taxon 34: 296–297. 1985) briefly discussed this species and formally synonymized *Hedyotis elegans* Wallich ex Kurz with it; however, they gave no characters or discussion of either species and gave its range as “Burma and Malaysia” even though its type is from Hong Kong, so their conclusions are provisionally not included here.

## 2. *Hedyotis ampliflora* Hance, J. Bot. 17: 11. 1879.

广花耳草 *guang hua er cao*

*Oldenlandia ampliflora* (Hance) Kuntze.

Herbs or shrubs, perennial, lianescent, clambering, twining, or scandent, to perhaps 1 m; stems flattened to subterete, smooth to sulcate, densely hirtellous or pilosulous throughout or in lines, to glabrescent. Leaves petiolate; petiole 2–6 mm, densely hirtellous to puberulent; blade drying papery, lanceolate, broadly lanceolate, elliptic, or narrowly elliptic, 2–7 × 0.8–3 cm, adaxially hispidulous or strigillose along midrib to throughout, abaxially hispidulous or hirtellous to glabrous, base cuneate to obtuse, apex acute or shortly acuminate; secondary veins 3 or 4 pairs; stipules fused to petiole bases, densely hirtellous to hispidulous, sheath portion 1–3 mm, truncate to triangular, apex lacerate into 3–5 narrowly triangular to linear bristles or lobes 1–6 mm. Inflorescences terminal and occasionally also in axils of uppermost leaves, compound-cymose, corymbiform, 3–12 cm, several to many flowered, densely to sparsely hirtellous to puberulent, pedunculate; peduncles 1–3.5 cm; axes dichotomous, spreading; bracts triangular, lanceolate, or narrowly elliptic, 1–7 mm; pedicels 1–3.5 mm. Flowers pedicellate, apparently distylous. Calyx glabrous to densely hirtellous; hypanthium portion subglobose or turbinate, 0.8–1 mm; limb lobed for 3/4–4/5; lobes lanceolate to spatulate, 1.2–1.8

mm, acute, usually spreading to reflexed. Corolla white or greenish white, tubular to salverform, outside granular-puberulent; tube ca. 1 mm, barbate in throat; lobes lanceolate to spatulate, 2–2.5 mm, acute. Anthers partially or long exerted, 0.8–1 mm. Stigmas in short-styled form not seen, or exerted and ca. 0.3 mm. Fruit capsular, subglobose to ovoid, sometimes slightly flattened, 2.5–3 × 2–2.5 mm, glabrous to densely hirtellous, cartilaginous to stiffly papery, loculicidal then septicial across top then tardily along sides, beak conical, ca. 1 mm; seeds numerous, blackish brown, angled. Fl. May–Nov, fr. Oct–Nov.

- Sparse forests or thickets on mountain slopes; 100–400 m. Hainan.

The Kew Rubiaceae checklist (Govaerts et al., World Checkl. Rubiaceae; <http://www.kew.org/wcsp/rubiaceae/>; accessed on May 2007) reports this species also from Vietnam; it is not listed in the Vietnam checklist.

## 3. *Hedyotis assimilis* Tutcher, Rep. Bot. Dept. Hong Kong 1914: 32. 1915.

清远耳草 *qing yuan er cao*

*Oldenlandia assimilis* (Tutcher) Chun.

Herbs or subshrubs, erect, branched, 30–40 cm tall; stems quadrangular, scabrous. Petiole ca. 3 mm; leaf blade drying papery, lanceolate, 5–9 × 1.5–2.5 cm, scabrous, base cuneate, apex long acuminate; secondary veins ca. 4 pairs, adaxially impressed; stipules broadly triangular, ca. 3 mm, usually 4–6-lobed or perhaps setose. Inflorescence axillary and terminal, in cymes arranged into panicles, usually shorter than leaves, 6–8-flowered; bracts small, narrow; pedicels 1–3 mm. Flowers pedicellate, with biology unknown. Calyx glabrous; lobes ovate, acute. Corolla white, outside glabrous, inside and on filaments densely bearded; lobes lanceolate, longer than tube, obtuse. Style exerted, bearded below middle. Fruit capsular, ellipsoid, ca. 3 mm including persistent calyx limb, septicial then loculicidal through middle of septum; seeds numerous, black, angled. Fl. Apr–May.

- Broad-leaved forests, slopes in ravines. Guangdong (Conghua, Qingyuan).

## 4. *Hedyotis auricularia* Linnaeus, Sp. Pl. 1: 101. 1753.

耳草 *er cao*

Herbs, perennial, tufted to weak or procumbent, sometimes (var. *auricularia*) to usually (var. *mina*) rooting at lowermost nodes, to 1 m tall or long; stems flattened, 4-angled, or terete becoming angled and/or sulcate, densely hirtellous, hispidulous, strigillose, pilosulous, or puberulent, to sometimes glabrescent (var. *auricularia*), or glabrous except villosulous to pilosulous and sometimes also hirsute to pilose inside grooves (var. *mina*). Leaves subsessile to petiolate; petiole to 7 mm, densely strigillose to pilosulous; blade drying subleathery to papery, ovate, lanceolate, elliptic, or elliptic-oblong, 2.2–9 × 0.6–3 cm (var. *auricularia*) or 1.2–3 × 0.4–1.4 (var. *mina*), adaxially glabrous or puberulent along midrib or scabrous, abaxially glabrous on lamina and densely puberulent to strigillose or hispidulous along principal veins and margins, base acute to obtuse and sometimes shortly decurrent, apex acute or

acuminate; secondary veins 4–6 (var. *auricularia*) or 2–4 (var. *mina*) pairs; stipules fused to petiole bases, densely puberulent, strigillose, or pilosulous, sheath 1.5–3.5 mm, truncate to triangular or elliptic, in var. *auricularia* with 3–9 linear or setiform lobes 0.5–5 mm, often glandular at apex, in var. *mina* entire and acute to aristate or sometimes with 2 setose lobes to 2 mm. Inflorescences axillary, glomerulate to congested-cymose, 5–12 mm in diam., several to many flowered (var. *auricularia*) or 2–7-flowered (var. *mina*), puberulent, sessile; bracts lanceolate to stipuliform, 0.3–2 mm; pedicels to 1 (var. *auricularia*) or 3 (var. *mina*) mm. Flowers sessile to pedicellate, distylous. Calyx puberulent (var. *auricularia*) or glabrous (var. *mina*); hypanthium portion obconic, ca. 1 mm; limb lobed essentially to base; lobes lanceolate to triangular, 0.8–1.2 mm, usually ciliolate. Corolla white, tubular or tubular-funnelform, outside pilosulous at least on lobes (var. *auricularia*) or glabrous throughout (var. *mina*); tube 1–1.5 mm, barbate in throat; lobes 0.5–1 mm. Anthers narrowly oblong, ca. 1 mm, exerted or included. Stigma ca. 1 mm, exerted or included. Fruit indehiscent, globose to ovoid, 1.2–1.5 mm in diam., sparsely hirtellous, hispidulous, or puberulent (var. *auricularia*), or glabrous (var. *mina*), sometimes with peduncles and/or pedicels elongating, to 2 mm; seeds 4–12, black, foveolate. Fl. and fr. Mar–Dec.

Forest margins, thickets, grasslands, open fields, streamsides; below 100–1500 m. Guangdong, Guangxi, Guizhou, Hainan, Yunnan [India, Japan (Ryukyu Islands), Malaysia, Myanmar, Nepal, Philippines, Sri Lanka, Thailand, Vietnam; Australia].

- 1a. Young stems densely hirtellous, hispidulous, strigillose, pilosulous, or puberulent to glabrescent; leaf blade lanceolate to elliptic, 2.2–9 × 0.6–3 cm; secondary veins 4–6 pairs ..... 4a. var. *auricularia*
- 1b. Young stems longitudinally sulcate, glabrous except villosulous to pilosulous and sometimes also hirsute to pilose inside grooves; leaf blade ovate to lanceolate, elliptic, or elliptic-oblong, 1.2–3 × 0.4–1.4 cm; secondary veins 2–4 pairs ..... 4b. var. *mina*

#### 4a. *Hedyotis auricularia* var. *auricularia*

耳草(原变种) er cao (yuan bian zhong)

*Exallage auricularia* (Linnaeus) Bremekamp; *Oldenlandia auricularia* (Linnaeus) K. Schumann.

Stems densely hirtellous, hispidulous, strigillose, pilosulous, or puberulent to glabrescent with pubescence mostly uniform. Leaf blade lanceolate to elliptic, 2.2–9 × 0.6–3 cm; secondary veins 4–6 pairs; stipules with 3–9 linear to setiform lobes to 5 mm. Inflorescences glomerulate to congested-cymose, several to many flowered; pedicels to 1 mm. Fl. and fr. Mar–Dec.

Forest margins, thickets, grasslands; below 100–1500 m. Guangdong, Guangxi, Guizhou, Hainan, Yunnan [India, Japan (Ryukyu Islands), Malaysia, Myanmar, Nepal, Philippines, Sri Lanka, Thailand, Vietnam; Australia].

The Chinese range of this taxon was not mentioned by Dutta and Deb (Taxon. Rev. *Hedyotis*. 2004) but was long known to other authors.

4b. *Hedyotis auricularia* var. *mina* W. C. Ko, Fl. Hainan. 3: 578. 1974.

细叶亚婆潮 xi ye ya po chao

Stems at least when young longitudinally sulcate, villosulous to pilosulous and sometimes also hirsute to pilose inside grooves. Leaf blade ovate to lanceolate, elliptic, or elliptic-oblong, 1.2–3 × 0.4–1.4 cm; secondary veins 2–4 pairs; stipules entire and acute to aristate or sometimes with 2 setose lobes to 2 mm. Inflorescences subcapitate to congested-cymose, 2–7-flowered in each node; pedicels to 3 mm. Fl. almost year-round.

• Wet or humid open fields, streamsides, thickets; ca. 200 m. Guangdong, Guangxi, Hainan.

5. *Hedyotis baotingensis* W. C. Ko, J. S. China Agric. Univ. 16(4): 43. 1995.

保亭耳草 bao ting er cao

Little branched herbs, prostrate, 40–60 cm tall; stems terete to flattened, scabrous. Leaves petiolate, often congested and appearing verticillate at top of stem; petiole 10–15 mm; blade drying papery, elliptic, elliptic-oblong, ovate, or obovate, 4–13 × 3–6 cm, adaxially glabrous, abaxially sparsely hirtellous at least along veins, base obtuse then decurrent, apex obtuse then sometimes abruptly and shortly acute; secondary veins 5–12 pairs; stipules narrowly triangular, long acuminate, marginally erose. Inflorescence and flowers unknown. Inflorescence terminal, capitate, subglobose, 2–2.5 cm in diam., sessile. Fruit indehiscent, sessile or subsessile, globose or ellipsoid, 1–1.5 mm in diam., pilosulous; persistent calyx lobes narrowly spatulate-oblong, narrowly lanceolate, or linear, 5–5.5 mm, striate; seeds 3 or 4, black, angled. Fr. Oct.

• Broad-leaved forests on shady slopes. Hainan (Baoting).

6. *Hedyotis biflora* (Linnaeus) Lamarck, Tabl. Encycl. 1: 272. 1792.

双花耳草 shuang hua er cao

*Oldenlandia biflora* Linnaeus, Sp. Pl. 1: 119. 1753; *Hedyotis paniculata* (Linnaeus) Lamarck; *H. racemosa* Lamarck; *O. crassifolia* Candolle; *O. paniculata* Linnaeus.

Herbs, annual or perennial, erect to procumbent, to 15(–30) cm tall; stems 4-angled to subterete and/or sulcate, glabrous. Leaves subsessile to petiolate; petiole to 0.5 cm, glabrous; blade drying papery to subleathery, elliptic-oblong, elliptic-ovate, obovate, oblanceolate, or elliptic, 1–4 × 0.3–1 mm, glabrous, base acute to obtuse then abruptly decurrent, apex acute to rounded; secondary veins indistinct; stipules fused to petioles, triangular, 1–2 mm, glabrous, usually costate, acute to long acuminate. Inflorescences terminal and in axils of uppermost leaves, cymose to compound-cymose, 1–6 cm, glabrous, 2–12-flowered, pedunculate; peduncles 0.5–3 cm; bracts triangular to lanceolate, 0.5–3 mm; pedicels 0.5–10 mm. Flowers subsessile to pedicellate, apparently distylous. Calyx glabrous; hypanthium portion turbinate, 0.5–1 mm; limb lobed essentially to base; lobes triangular, 0.3–1 mm. Corolla white, sometimes flushed with lavender, tubular to somewhat urceolate, outside glabrous or puberulent in lines; tube 1.2–2 mm, barbate in

throat; lobes spatulate-oblong, 1–1.5 mm. Anthers included or exerted, 0.3–0.5 mm. Stigma exerted or apparently included, ca. 0.2 mm. Fruit capsular, subglobose, obovate, or hemispherical, 2.5–3 mm in diam., loculicidally dehiscent across top, beak 0.5–1 mm high, pedicels usually elongating; seeds numerous, black, foveolate. Fl. and fr. Jan–Sep.

Limestone mountains, coastal areas, weedy fields, wastelands; sea level to 1200 m. Fujian, Guangdong, Guangxi, Hainan, Jiangsu, Taiwan, Yunnan [India, Indonesia, Malaysia, Nepal, Vietnam; SE Asia to Pacific islands].

The circumscription and name of this species is controversial or, at best, complicated. These are small herbs of ruderal sites and thus probably respond markedly to local conditions, in particular growing to a larger size with larger leaves, inflorescences, and fruit in sites with better conditions. Similar species that have been variously synonymized but are separated here include *Hedyotis strigulosa* and *H. pterita*; see further discussion under *H. strigulosa*. Alternatively Biju et al. (Rheedea 2(1): 11–18. 1992) separated *H. biflora* from *H. racemosa* (syn. *Oldenlandia paniculata*); their treatment is carefully done but regional, and because their key does not correspond well with the Chinese plants, their conclusions are not accepted here.

The name *Oldenlandia crassifolia* was placed in synonymy with both *Hedyotis biflora* and *H. coreana* (*H. strigulosa*) by W. C. Ko (in FRPS 71(1): 39, 77. 1999). The only other author who studied this name in any detail, Merrill (Enum. Philipp. Fl. Pl. 3(4): 492–512; 3(5): 513–576. 1923), cited this as a synonym of *H. biflora* and is followed here.

**7. *Hedyotis bodinieri*** H. Léveillé, Repert. Spec. Nov. Regni Veg. 11: 64. 1912.

大冒山耳草 da mao shan er cao

*Oldenlandia bodinieri* (H. Léveillé) Chun.

Herbs or subshrubs; stems pilosulous. Leaf blade drying membranous, margins not revolute when dry. Inflorescence shortly cymose. Flowers pedicellate. Calyx lobes sublinear, acute, as long as corolla tube. Corolla white; tube slightly longer than lobes. Anthers included. Fl. May.

• Mountaintops. Hong Kong (Damao Shan).

This very poorly known species is not included in the key to species here. It may well turn out to be an older name for an otherwise-known species.

**8. *Hedyotis brachypoda*** (Candolle) Sivarajan & Biju, Taxon 39: 672. 1990.

拟定经草 ni ding jing cao

*Oldenlandia brachypoda* Candolle, Prodr. 4: 424. 1830.

Slender herbs, annual, diffusely branched, to 50 cm tall; stems terete to slightly flattened, glabrous. Leaves sessile or subsessile; blade drying membranous, linear, narrowly elliptic, or narrowly spatulate, 7–36 × 1–4 mm, adaxially glabrous (sometimes appearing papillose due to collapsed, large epidermal cells) to scaberrulous and usually shiny, abaxially glabrous and matte, base acute, margins usually revolute at least when dry, apex acute; secondary veins not evident; stipules fused to petiole bases, glabrous, truncate to broadly triangular, 0.8–2 mm, with 1–3 linear to setiform lobes 0.2–1 mm. Inflorescences

pseudoaxillary, 1-flowered (2-flowered and fasciculate), glabrous, sessile or with peduncle to 3 mm, ebracteate. Flowers subsessile to shortly pedunculate, homostylous. Calyx glabrous; hypanthium portion globose, 1–1.2 mm; limb lobed essentially to base; lobes triangular, 1–1.5 mm. Corolla white, rotate, outside glabrous; tube 1–1.5 mm, glabrous at throat; lobes triangular, 1–1.5 mm. Anthers ca. 0.3 mm, exerted. Stigma ca. 0.8 mm, exerted. Fruit capsular, membranous to papery, compressed globose to subglobose or somewhat dicocous, ca. 2.5 × 3–4 mm, loculicidally dehiscent through flattened top, peduncles to 8 mm; seeds ca. 20, dark brown, angled, deeply and thickly foveolate. Fl. and fr. (Feb–)Mar–Nov.

Paddy fields, ridges of farmlands, humid open fields; below 100–1500 m. Anhui, Guangdong, Guangxi, Hainan, Yunnan [Bangladesh, Bhutan, India, Indonesia, Japan, Malaysia (Malacca), Nepal, Philippines, Vietnam].

The taxonomy of this and related species is complicated, and different authors have drawn very different conclusions (e.g., Sivarajan & Biju, loc. cit.: 665–674; Dutta & Deb, Taxon. Rev. *Hedyotis*. 2004). In particular, *Hedyotis corymbosa*, *H. diffusa*, and *H. erecta* Manilal & Sivarajan are related and have been variously circumscribed. Here, these species are circumscribed generally, though not completely, following Sivarajan and Biju (loc. cit.) and W. C. Ko (in FRPS 71(1): 72, 75. 1999).

**9. *Hedyotis bracteosa*** Hance, J. Bot. 23: 323. 1885.

大苞耳草 da bao er cao

*Oldenlandia bracteosa* (Hance) Kuntze.

Herbs, erect, to 50 cm tall; stems glabrous, 4-angled with angles rounded to acute or winged, wings to 1 mm wide. Leaves sessile or subsessile; blade drying papery, elliptic-oblong or oblong-lanceolate, 12–15 × 2–4 cm, glabrous, base obtuse to cordulate then abruptly narrowed, apex acute or shortly acuminate; secondary veins ca. 7 pairs, weakly marked or not visible; stipules fused to petiole bases, broadly triangular to ovate, 4–12 mm, glabrous, with 2 winged flanges 1–2.5 mm wide extending from each petiole base to apex, entire or glandular-serrulate, acute to acuminate. Inflorescence axillary, capitate, glabrous, pedunculate; peduncles 2.5–7 cm; involucre bracts 2 or 4, ovate, 10–25 × 9–18 mm; head hemispherical, 10–16 mm in diam.; floral bracts narrowly lanceolate, 1–4 mm; pedicels 0.2–1 mm. Flowers subsessile to shortly pedicellate, distylous. Calyx glabrous; hypanthium portion ellipsoid, ca. 1 mm; limb lobed nearly to base; lobes ovate or lanceolate, 2.2–3 × 1.2–2 mm, often pinnately veined, sometimes ciliolate, obtuse to acute. Corolla white, tubular or tubular-funnelform, outside glabrous; tube ca. 4 mm, pilosulous inside in upper half and throat; lobes lanceolate to triangular, ca. 1.5 mm, acute. Anthers exerted and ca. 0.8 mm in short-styled form, in long-styled form not seen. Stigmas ca. 0.5 mm and positioned near middle of corolla tube in short-styled form, ca. 1 mm and exerted in long-styled form. Fruit capsular, subglobose to ellipsoid, ca. 2 mm, glabrous, septicidal then perhaps rather tardily loculicidal, with calyx limb persistent; seeds numerous, black, angled, rugose. Fl. Apr–Jul, fr. Jul.

• Sparse forests on mountain slopes or on humid lands in valleys/ravines. Guangdong.

W. C. Ko (in FRPS 71(1): 56. 1999) described the corolla as having lobes as long as the corolla tube, but this has not been seen on specimens studied nor reported by other authors.

**10. *Hedyotis brevicalyx*** Sivarajan, Biju & P. Mathew, Kew Bull. 48: 393. 1993.

伞形花耳草 san xing hua er cao

*Oldenlandia umbellata* Linnaeus, Sp. Pl. 1: 119. 1753; *Hedyotis umbellata* (Linnaeus) Lamarck (1792), not Walter (1788).

Herbs, annual or perennial, diffusely branched, to 40 cm tall; stems 4-angled perhaps becoming terete, ribbed, scaberulous. Leaves opposite but often crowded and appearing verticillate, sessile; blade drying papery, linear to narrowly lanceolate, 10–20 × 1–3 mm, adaxially punctate and glabrescent, abaxially scaberulous along midrib, base acute, margins flat to revolute, apex acute; secondary veins indistinct; stipules fused to petioles, glabrescent, truncate to rounded, 1–1.5 mm, with 2–5 bristles 1–2 mm. Inflorescence terminal and sometimes in uppermost axils, congested-cymose to congested-umbelliform, several flowered, scaberulous, pedunculate; peduncles 1–2 cm; branched portion ca. 3 cm; bracts stipuliform, ca. 1 mm; pedicels 0.5–1.2 mm. Flowers distylous, shortly pedicellate. Calyx apparently glabrous; hypanthium portion subglobose to ovoid, 0.3–1 mm; limb lobed essentially to base; lobes lanceolate to triangular, 1–2 mm, ciliate. Corolla white, tubular, outside glabrous; tube 1.5–2.2 mm, glabrous inside; lobes lanceolate, 1.5–2 mm, inside sparsely pubescent. Anthers 0.5–1 mm, included or exerted. Stigmas 0.8–1 mm, included or exerted. Fruit capsular, compressed globose to weakly didymous, 2–2.5 × 2–2.5 mm, loculicidally dehiscent across top, glabrous to scaberulous, perhaps papery; seeds several, blackish brown.

Sandy lands at sea beaches; sea level to near sea level [100–900 m in India]. Hainan (Lingshui) [India, Indonesia (Java), N Myanmar, Pakistan, Sri Lanka, Vietnam].

There is some disagreement over the identity and correct name of this species; whether *Hedyotis brevicalyx* actually occurs in China is unknown as yet, and the description here is taken from Dutta and Deb (Taxon. Rev. *Hedyotis*. 2004, as *H. puberula* (G. Don) R. Brown ex Arnott). The plant illustrated for this species (as *H. umbellata*) in FRPS (71(1): 70, t. 13, f. 1–6. 1999) is actually *H. pinifolia*, and its description there seems to combine some characters of both *H. brevicalyx* sensu Dutta & Deb and *H. pinifolia*.

**11. *Hedyotis butensis*** Masamune, Trans. Nat. Hist. Soc. Formosa 28: 119. 1938.

台湾耳草 tai wan er cao

Herbs, erect, annual, to 20 cm tall; stems terete to 4-angled, hirsute. Leaves sessile; blade drying papery, elliptic-oblong, oblanceolate, ovate-lanceolate, or lanceolate, 1.5–6 × 0.3–1 cm, adaxially puberulent to scaberulous, abaxially densely villous to hirsute, base cuneate to attenuate, apex acute to acuminate; stipules broadly triangular, ca. 3 mm, hirsute, acuminate. Inflorescences terminal and/or axillary, capitate or glomerulate; bracts linear, to 1.5 mm. Flowers sessile. Calyx hirsute; hypanthium portion ovoid, ca. 1.5 mm; lobes linear to deltoid, ca. 1.5 mm. Corolla white, funnelliform, pubescent inside and

out; tube 0.8–2.3 mm; lobes oblong-linear, ca. 0.2 mm. Anthers exerted. Fruit indehiscent or dehiscent across top, subglobose, somewhat compressed laterally, 1.5–2 mm in diam.; seeds numerous, angled. Fl. Jul–Sep.

• Taiwan (Yilan).

This species is poorly known, and the available descriptions are limited. It is included in the key to species twice, for the described hirsute stems and the potentially glabrous stems, a condition eventually found in most pubescent species of *Hedyotis* (and other Rubiaceae) and one that can be confirmed as more specimens become available.

**12. *Hedyotis cantoniensis*** F. C. How ex W. C. Ko, J. S. China Agric. Univ. 16(4): 42. 1995.

广州耳草 guang zhou er cao

Herbs or subshrubs, erect, perennial, to 60 cm tall; stems subterete, sometimes striate, glabrous. Leaves subsessile to petiolate; petiole to 8 mm, glabrous; blade drying thinly leathery, ovate, oblong-elliptic, narrowly elliptic, or narrowly lanceolate, 3–13 × 0.8–3 cm, glabrous, base acute to cuneate, apex acute to shortly acuminate; secondary veins indistinct; stipules fused to petiole bases, triangular to broadly triangular, 2–5 mm, glabrous, marginally entire to densely glandular serrate, acute to aristate with tip to 4 mm. Inflorescences terminal and in axils of uppermost leaves, cymose, paniculate and pyramidal to narrowly cylindrical or racemiform, 1–15 cm, several to many flowered, glabrous, sessile and tripartite or pedunculate; peduncles 1–4.5 cm; bracts narrowly elliptic to triangular, 0.5–4 mm; pedicels to 1 mm. Flowers sessile to pedicellate, distylous. Calyx glabrous; hypanthium portion subglobose to obconic, 1–1.2 mm; limb 1–2 mm, deeply lobed; lobes triangular to narrowly triangular. Corolla salverform to tubular-funnelform, outside glabrous; tube 2.5–3.5 mm, sparsely barbate in throat; lobes oblong-lanceolate, 2–2.2 mm. Anthers included or exerted, ca. 1.1 mm. Stigmas included or exerted, ca. 0.3 mm when exerted. Fruit capsular, ellipsoid to subglobose, 2–3 mm, septically then loculicidally dehiscent, glabrous, cartilaginous to somewhat woody, apex flat or with low rounded beak; seeds several, angled. Fl. Apr–Aug, fr. Jun–Nov.

• Sparse forests; 200–1000 m. Guangdong.

This species as provisionally circumscribed here is similar to *Hedyotis matthewii* and slightly differently (and more narrowly) than done by W. C. Ko (in FRPS 71(1): 48. 1999).

**13. *Hedyotis capitellata*** Wallich ex G. Don, Gen. Hist. 3: 527. 1834.

头花耳草 tou hua er cao

Herbs or shrubs, lianescent, climbing, clambering, or scandent, to 1 m; stems terete to weakly 4-angled, often longitudinally ridged and/or sulcate, glabrous or hirtellous to pilosulous or hispidulous at least in longitudinal lines, or tomentose in var. *mollissima*. Leaves subsessile to petiolate; petiole to 4 mm, glabrous to puberulent or hispidulous, or tomentose (var. *mollissima*); blade drying membranous, ovate, lanceolate, elliptic, or elliptic-lanceolate, 2–12 × 1–4 cm, glabrous or sparsely to moderately puberulent to hispidulous or hirtellous, or tomentose (var. *mollissima*), base acute to obtuse then often decurrent,

apex acute to shortly or long acuminate; secondary veins 3 or 4 pairs; stipules fused to petiole bases, glabrous to densely puberulent, hispidulous, or strigillose, or tomentose (var. *mollissima*), triangular, 1.5–5 mm, entire or serrulate at margins, acute to acuminate with tip 0.5–1.5 mm, often spreading to recurved. Inflorescences terminal and often also in axils of uppermost leaves, 4–25 cm, with 3–15 globose, capitate to subcapitate heads in groups of 3, groups then paniculate, pyramidal, densely puberulent to hirtellous or glabrous, or tomentose (var. *mollissima*), pedunculate; peduncle 1–5 cm; bracts subtending axes triangular to oblanceolate, 1–10 mm, bracts subtending flowers reduced to a tuft of pubescence; heads 3–6 mm in diam. (not including corollas), 8–15 mm in diam. (including corollas). Flowers sessile or subsessile, distylous. Calyx glabrous to densely puberulent; hypanthium portion campanulate to obconic, 0.8–1 mm; limb lobed for 1/3–3/4, 1–2 mm; lobes oblong to narrowly triangular. Corolla white to pale blue, funnellform, outside glabrous, inside densely bearded in throat and onto lobes; tube 1–2 mm; lobes ligulate, 3–5 mm. Anthers included or exerted, 1–1.2(–2) mm. Stigmas linear, 1–2 mm. Fruit capsular, ellipsoid to globose, 2–3 mm in diam., glabrescent, septicidally then loculicidally dehiscent (but see discussion below); seeds numerous, angled. Fl. almost year-round, fr. not seen from China.

Broad-leaved forests in valleys, sunny mountain slopes; ca. 1500 m. Yunnan [India, Indonesia, Malaysia, Myanmar, Thailand, Vietnam].

The fruit is described above following W. C. Ko (in FRPS 71(1): 65. 1999); however, Dutta and Deb (Taxon. Rev. *Hedyotis*. 2004) described this differently, as loculicidal across the top beak portion, then sometimes tardily septicidal.

W. C. Ko (loc. cit.: 65–66) reported the varieties below from China; they are treated following that work here for reference. Dutta and Deb (loc. cit.) reported only *Hedyotis capitellata* var. *subpubescens* Kurz from China; this name was not mentioned by Ko but presumably corresponds to one of Dutta and Deb's varieties.

- 1a. Plants glabrous ..... 13a. var. *capitellata*  
 1b. Plants pubescent.  
 2a. Stems, inflorescences, calyx, and  
 leaf blade sparsely pubescent ..... 13b. var. *mollis*  
 2b. Stems, inflorescences, calyx, and  
 leaf blade densely pale yellow  
 tomentose ..... 13c. var. *mollissima*

### 13a. *Hedyotis capitellata* var. *capitellata*

头状花耳草(原变种) tou zhuang hua er cao (yuan bian zhong)

*Oldenlandia capitellata* (Wallich ex G. Don) Kuntze; *O. capitellata* var. *glabra* Pitard; *O. rubioides* Miquel.

Plants glabrous. Fl. May, fr. not seen from China.

Broad-leaved forests in valleys; ca. 1500 m [as low as below 100 m in India]. Yunnan [India, Indonesia, Malaysia, Myanmar, Thailand].

**13b. *Hedyotis capitellata* var. *mollis*** (Pierre ex Pitard) T. N. Ninh in T. B. Nguyen, Fl. Taynguyen. Enum. 150. 1984.

疏毛头状花耳草 shu mao tou zhuang hua er cao

*Oldenlandia capitellata* var. *mollis* Pierre ex Pitard in Lecomte, Fl. Indo-Chine 3: 137. 1922.

Stems, leaf blade, inflorescences, and calyx sparsely pubescent. Fl. Apr–Jul, fr. not seen from China.

Broad-leaved forests at middle elevations. Yunnan (Hekou) [India, Indonesia, Malaysia, Vietnam].

Ninh's varietal combination was not known to W. C. Ko (loc. cit.: 66), who intended to publish it himself but was precluded.

**13c. *Hedyotis capitellata* var. *mollissima*** (Pitard) W. C. Ko, Fl. Reipubl. Popularis Sin. 71(1): 66. 1999.

绒毛头状花耳草 rong mao tou zhuang hua er cao

*Oldenlandia capitellata* var. *mollissima* Pitard in Lecomte, Fl. Indo-Chine 3: 138. 1922.

Stems, leaf blade, inflorescences, and calyx densely pale yellow tomentose. Fl. almost year-round, fr. not seen from China.

Sunny mountain slopes at middle to high elevations. Yunnan (Xishuangbanna) [Vietnam].

**14. *Hedyotis capituligera*** Hance, J. Bot. 17: 12. 1879.

败酱耳草 bai jiang er cao

*Oldenlandia capituligera* (Hance) Kuntze.

Leggy herbs, erect, to 80 cm tall; stems terete to 4-angled, longitudinally usually sulcate, sparsely villosulous or hirtellous to densely so at least in longitudinal lines, becoming glabrescent. Leaves subsessile to shortly petiolate; blade drying membranous, oblong-lanceolate, 3.5–11.5 × 0.8–3.5 cm, adaxially glabrous or sparsely to densely puberulent, hirtellous, or hispid, abaxially glabrescent on lamina and hispid to pilosulous or pilose along veins, base acute to rounded, margins ciliate, apex obtuse to acute; secondary veins 5–8 pairs; stipules fused to petiole bases, triangular, 1.5–4 mm, moderately to densely hirtellous or villosulous, with 2–4 bristles or linear to narrowly triangular lobes 1.5–4 mm. Inflorescences terminal on main stems, short lateral stems, and sometimes also in axils of uppermost leaves, several to many flowered, with 1–8 congested-cymose to subcapitate heads or glomerules, these usually in compound cymes 2–18 cm, densely villosulous to strigillose or glabrescent, pedunculate; peduncles 1–10 cm; heads 0.8–1.5 cm in diam.; bracts narrowly triangular to narrowly elliptic, 1.2–7 mm. Flowers subsessile. Calyx glabrous; hypanthium portion subglobose, ca. 0.8 mm; limb lobed nearly to base; lobes triangular, 0.3–0.6 mm. Corolla white, funnellform, outside glabrous; tube ca. 3 mm, stiffly barbate in throat; lobes ca. 1.3 mm, thickened at apex. Fruit capsular, compressed globose, dehiscent; seeds several. Fl. Jul–Aug.

• Open grasslands. Guangdong, Guizhou, Yunnan.

**15. *Hedyotis cathayana*** W. C. Ko, Fl. Hainan. 3: 579. 1974.

中华耳草 zhong hua er cao

Herbs or shrubs, presumably perennial, erect, to 80(–100) cm tall; stems glabrous, 4-angled, angles sharp to winged, wings to 2 mm wide. Leaves sessile or subsessile; blade drying papery to membranous, purple on midrib at least when young, elliptic-oblong, lanceolate, or oblanceolate, 15–25 × 3–6

cm, glabrous, base obtuse to rounded or truncate, apex acute to long acuminate; secondary veins 7 or 8 pairs, hardly visible; stipules apparently fused shortly around stem, broadly triangular, 4–12 mm, glabrous, with 2 winged flanges 1–2 mm wide extending from each petiole base up to apex, acute to acuminate, entire, sparsely glandular-serrate, or with 1 to numerous bristles 0.1–2 mm, gland-tipped. Inflorescence axillary, congested-cymose to shortly paniculate or subglomerulate, 1.5–3.5 cm, glabrous, subsessile to pedunculate; peduncles to 2 cm; bracts linear-lanceolate, lanceolate, or narrowly elliptic, 1–12 mm; pedicels to 1.5 mm. Flowers subsessile to pedicellate, ?apparently distylous. Calyx glabrous; hypanthium turbinate, 1–1.3 mm; limb deeply lobed; lobes narrowly triangular to spatulate, 2–3 mm, sometimes slightly unequal. Corolla white or pale green, funnelform to tubular-funnelform, outside glabrous; tube 6–9 mm, bearded in throat; lobes spatulate-oblong, 2.5–4 mm. Anthers exerted, 1–1.5 mm. Stigma ca. 1.5 mm, included, positioned just above middle of corolla tube. Fruit capsular, subglobose to ovoid, 2–3 × 1.5–2 mm, septicidal then loculicidal, papery, glabrous; seeds 4–6, blackish brown, angled, papillose. Fl. and fr. almost year-round, often simultaneously.

- On wet soil in valleys and ravines; ca. 500 m. Hainan.

The specimen *H. Y. Liang 54367* (NY, Web!) was annotated as “*Hedyotis Liangii* Merr. & Chun,” but this name was apparently never published.

**16. *Hedyotis caudatifolia*** Merrill & F. P. Metcalf, J. Arnold Arbor. 23: 228. 1942.

剑叶耳草 jian ye er cao

*Hedyotis hui* Diels.

Shrubs or perhaps subshrubs, erect, perennial, to 90 cm tall; stems terete, shallowly striate, glabrous. Leaves petiolate; petiole 10–15 mm; blade drying leathery, grayish white abaxially, lanceolate, 6–13 × 1.5–3 cm, base cuneate or decurrent, apex caudate-acuminate; secondary veins ca. 4 pairs but indistinct; stipules broadly ovate, 2–3 mm, entire or glandular-serrulate, acute. Inflorescences compound-cymose to paniculate, several to many flowered; axes generally dichotomous; bracts lanceolate or linear-lanceolate. Flowers shortly pedicellate. Calyx with hypanthium portion turbinate, ca. 3 mm; limb deeply lobed; lobes ovate-triangular. Corolla white or pink, tubular, outside glabrous; tube 4–8 mm, barbate in throat; lobes lanceolate. Stigmas exerted or included. Fruit capsular, ellipsoid-oblong or ellipsoid, ca. 2.5 × 2 mm, smooth, glabrous, dehiscent; seeds several, black, subtriangular. Fl. May–Jun.

- Dry soil in jungles, thickets, on rock cliffs, on clay soil in grasslands. Fujian, Guangdong, Guangxi, Hunan, Jiangxi, Zhejiang.

W. C. Ko (in FRPS 71(1): 48. 1999) described the petioles of this species as 10–15 mm and the hypanthium as ca. 3 mm, but the accompanying figure (p. 50, t. 7, f. 7–10) does not show these features.

**17. *Hedyotis cheniana*** R. J. Wang, Novon 18: 264. 2008.

焕铺耳草 huan yong er cao

Subshrubs, erect, to 0.5 m tall; stems terete to sulcate, glabrous to densely puberulent, strigillose, or pilosulous. Leaves

petiolate; petiole 3–5 mm, glabrous to densely pilosulous; blade drying papery, ovate, elliptic, ovate-oblong, or suborbicular, 1.7–5 × 1.6–2.5 cm, adaxially glabrescent, abaxially puberulent to pilosulous, base broadly obtuse to rounded or truncate, apex acute or shortly acuminate; secondary veins 3 or 4 pairs, poorly to well developed abaxially; stipules persistent, interpetiolar, triangular, 2–3.5 mm, glabrous or densely pilosulous, lacerate or with 5–9 linear lobes or bristles. Inflorescences terminal and in uppermost leaf axils, subcapitate, 1–2 cm in diam., 10–30-flowered, puberulent to pilosulous, subsessile to pedunculate; peduncles to 3 mm; bracts narrowly triangular to linear, 1–3 mm; pedicels 0.5–2 mm. Flowers distylous, shortly pedicellate. Calyx glabrous; hypanthium portion subglobose-ellipsoid, 0.8–1 mm; limb lobed nearly to base; lobes narrowly triangular, 3.5–4 mm, entire to ciliolate, acuminate. Corolla white, salverform, outside glabrous; tube ca. 5 mm, barbate in throat; lobes spatulate-oblong to lanceolate, ca. 2 mm. Anthers exerted or situated in corolla throat, 1–1.5 mm. Stigmas included or exerted, ca. 1 mm. Fruit capsular, subglobose, ca. 2 mm, glabrous, loculicidal then septicidal; seeds 6–10, angled, reticulate. Fl. Jan–Feb, fr. Jun–Nov.

- Dense forests; 600–1000 m. Hainan.

The protologue described *Hedyotis cheniana* as being glabrous, but two specimens cited there are in fact densely pubescent; the protologue also described the secondary veins as not visible, but in fact they are well developed and usually prominulous abaxially on these specimens.

**18. *Hedyotis chereevensis*** (Pierre ex Pitard) Fukuoka, S. E. Asian Stud. 8(3): 332. 1970.

越南耳草 yue nan er cao

*Oldenlandia chereevensis* Pierre ex Pitard in Lecomte, Fl. Indo-Chine 3: 143. 1922.

Herbs, erect, perhaps perennial, to 50 cm tall; stems flattened to 4-angled, often ridged, glabrous or puberulent to hispidulous at and shortly below nodes. Leaves subsessile to petiolate; petiole to 2 mm, puberulent to hispidulous; blade drying membranous, ovate, lanceolate, or elliptic, 2–7 × 0.8–3 cm, adaxially glabrous or puberulent on principal veins, abaxially sparsely to densely puberulent or hispidulous at least on principal veins, base cuneate to rounded then decurrent, apex acute to acuminate; secondary veins 5–7 pairs; stipules fused to petiole bases, ovate-lanceolate to triangular, 3–5 mm, densely puberulent, hirtellous, or hispidulous, acuminate to aristate, marginally lacinate or with several filamentous lobes to 1 mm, often glandular at apex. Inflorescences terminal and sometimes in axils of uppermost leaves, cymose to paniculate, 3–7 cm, several to many flowered, glabrous, usually slender, pedunculate; peduncles 1–2 cm; bracts lanceolate, 0.8–1 mm; pedicels 6–10 mm. Flowers all pedicellate. Calyx glabrous; hypanthium portion obconical, 0.5–0.8 mm; limb lobed essentially to base; lobes triangular, 0.1–0.3 mm. Corolla white, tubular to rotate, outside glabrous; tube 0.5–1 mm, inside apparently glabrous; lobes oblong-lanceolate, ca. 0.5 mm. Anthers exerted, ca. 0.5 mm. Stigma apparently exerted, ca. 0.2 mm. Fruit capsular, obconical, turbinate, or subglobose, often somewhat didymous, 1.5–2 × 1–1.5 mm, glabrous, loculicidally dehiscent across top,

beak rounded, ca. 0.4 mm high; seeds ca. 10, dark brown, angled. Fl. May–Jul.

On damp humus soil in forests; [below 100–1300 m in Thailand]. Hainan [Cambodia, Thailand, Vietnam].

The name *Hedyotis chereevensis* has been attributed to W. C. Ko (Fl. Hainan. 3: 306, 579. 1974), but this appears to be a later, superfluous combination.

**19. *Hedyotis chrysotricha*** (Palibin) Merrill, Lingnan Sci. J. 7: 322. 1931.

金毛耳草 jin mao er cao

*Anotis chrysotricha* Palibin, Bull. Herb. Boissier, sér. 2, 6: 20. 1906; *Oldenlandia chrysotricha* (Palibin) Chun.

Herbs, perennial or perhaps annual, procumbent, usually regularly rooting at nodes, to 40 cm; stems weakly 4-angled, flattened, or terete, sometimes 2-sulcate, moderately to densely hirtellous to pilosulous at least along grooves, sometimes glabrescent, trichomes often drying yellowed. Leaves subsessile to petiolate; petiole 1–3 mm, moderately to densely pilosulous to hirtellous; blade drying thinly papery, lanceolate, elliptic, or ovate, 0.8–3.2 × 0.5–1.4 cm, adaxially sparsely hirtellous, hispidulous, or scaberulous at least along margins, abaxially sparsely to densely hirtellous or pilosulous with pubescence denser along principal veins or sometimes glabrous (e.g., *Tsang 20859*, MO!), base cuneate or obtuse, apex obtuse to acute or shortly acuminate; secondary veins 2 or 3 pairs; stipules fused to petiole bases, triangular, 1–2 mm, moderately to densely puberulent to hirtellous, with 1–3 linear lobes or bristles 1.5–3.5 mm, these sometimes glandular and/or bifid at apex. Inflorescences axillary, congested-cymose to fasciculate, 3–10 mm in diam., (1 or) 2–5-flowered in each axil, moderately to densely pilosulous, sessile or subsessile; bracts linear, lanceolate, or narrowly elliptic, 0.5–4 mm; pedicels to 4 mm. Flowers subsessile to pedicellate, distylous. Calyx sparsely to densely hirtellous; hypanthium portion subglobose to obconic, ca. 1 mm; limb lobed essentially to base; lobes lanceolate to triangular, ca. 2 mm, usually ciliolate to ciliate. Corolla white or purple, funnel-form, outside pilosulous to glabrous; tube 2.5–4 mm, pubescent inside; lobes linear-oblong to triangular, 2.5–3 mm. Anthers exerted or included, 1–1.2 mm. Stigma exerted or included, 1–1.2 mm. Fruit indehiscent, subglobose to ovoid, 1.5–2 × 2–2.5 mm, with calyx lobes to 3 mm; seeds several. Fl. and fr. year-round.

Broad-leaved forests in valleys, thickets on mountain slopes; 100–900 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hubei, Hunan, Jiangsu, Jiangxi, Taiwan, Yunnan, Zhejiang [Japan, ?Philippines].

**20. *Hedyotis communis*** W. C. Ko, Fl. Hainan. 3: 579. 1974.

大众耳草 da zhong er cao

Subshrubs or herbs, erect, to 1.5 m tall; stems glabrous, flattened to 4-angled or terete. Leaves sessile to subsessile; blade drying papery, narrowly elliptic-oblong or narrowly elliptic, on vegetative stems, 10–17 × 1.5–2.6 cm, glabrous, base cuneate to acute then usually long decurrent, apex acute to acuminate; secondary veins 6–8 pairs, abaxially indistinct; stipules

shortly united around stem or sometimes fused to petiole bases, triangular to narrowly triangular, 8–13 mm, glabrous, long acuminate, marginally sometimes sparsely glandular-serrulate or -setose. Inflorescence axillary, paniculate-cymose with small cymes distributed along axes with leaflike bracts and bracteal stipules, or along axillary branches with reduced leaves (depending on interpretation), 7–24 cm, many flowered, glabrous, pedunculate; peduncle 0.5–4 cm; leaflike bracts or reduced leaves paired, lanceolate to narrowly elliptic, 10–40 mm; cymes 8–15 mm, several flowered; floral bracts linear or linear-lanceolate, 2–8 mm; pedicels to 1 mm. Flowers subsessile to pedicellate. Calyx glabrous; hypanthium portion ellipsoid, 1–1.2 mm; limb lobed nearly to base; lobes narrowly triangular, 2–3 mm. Corolla white, tubular, outside glabrous; tube 4.5–5 mm, bearded in throat; lobes spatulate-oblong to triangular, 2–2.5 mm, acute. Anthers exerted, ca. 1.2 mm. Stigma included, ca. 0.8 mm. Fruit capsular, obovoid or subglobose, 2–3 × 2–2.5 mm, glabrous, septically then loculicidally dehiscent, cartilaginous; seeds 2–4, brownish black, tuberculate. Fl. almost year-round, fr. May, Jun, Oct.

• On soil rich in humus in valleys or at streamsides; 900–1000 m. Hainan.

The inflorescences are borne laterally along well-developed axes with numerous leaflike bracts or reduced leaves, or alternatively along lateral branches with reduced leaves; various morphological descriptions of these have been used by different authors.

**21. *Hedyotis consanguinea*** Hance, Ann. Sci. Nat., Bot., sér. 4, 18: 221. 1862.

拟金草 ni jin cao

*Hedyotis lancea* Thunberg ex Maximowicz; *Oldenlandia consanguinea* (Hance) Kuntze; *O. lancea* (Thunberg ex Maximowicz) Kuntze.

Herbs or subshrubs, erect, perennial, to 40 cm tall; stems terete, flattened, or weakly 4-angled, smooth to sulcate, glabrous. Leaves subsessile to petiolate, sometimes appearing verticillate due to axillary groups of reduced leaves on unexpanded lateral stems; petiole to 6 mm, glabrous; blade drying stiffly papery to leathery, lanceolate, ovate, elliptic, lanceolate-elliptic, or elliptic-oblong, 1.5–12 × 0.4–4 cm, glabrous, base acute to obtuse and usually decurrent, margins plane to thinly revolute, apex acute to usually acuminate; secondary veins 2–4 pairs but mostly indistinct; stipules fused around stem, ovate to broadly triangular, 2–5.5 mm, glabrous, marginally glandular-serrulate, acute to acuminate or shortly aristate. Inflorescences terminal and in axils of uppermost leaves, compound-cymose, paniculate, 3–15 cm, many flowered, glabrous, pedunculate; peduncle 1–7 cm; axes strictly dichotomous then often spiciform (due to development of only 1 lateral axis, leaving 1 or 2 flowers at node), or sometimes scorpioid (due to development of alternating axes); bracts triangular to elliptic, 0.8–5 mm or those subtending principal axes sometimes leaflike; pedicels to 1 mm. Flowers sessile to shortly pedicellate, apparently distylous. Calyx glabrous; hypanthium portion obconic, 0.8–1 mm; limb deeply lobed; lobes lanceolate to triangular, 0.8–1.2 mm. Corolla white, salverform, outside glabrous; tube 1.5–2.5 mm, inside sparsely villosulous; lobes lanceolate, 1.5–2.5 mm. An-

thers included or exerted, ca. 0.8 mm. Stigma apparently included or exerted, ca. 0.3 mm. Fruit capsular, ellipsoid, ca. 2 × 2 mm, glabrous, woody, flattened to rounded on top, septically then loculicidally dehiscent; seeds numerous, blackish brown, angled. Fl. and fr. Jun–Nov.

• Grasslands, ditch sides; 400–1000 m. Fujian, Guangdong, Hainan, Zhejiang.

In the description here a distinction is made between the inflorescence axes and the pedicels; measurements in other descriptions sometimes include inflorescence axes that bear only a developed flower together with an undeveloped bud on an apparently indeterminate segment as pedicels and, thus, are correspondingly longer.

**22. *Hedyotis corymbosa*** (Linnaeus) Lamarck, Tabl. Encycl. 1: 272. 1792.

伞房花耳草 *san fang hua er cao*

Slender herbs, annual, to 40 cm tall; stems 4-angled to flattened, 2-sulcate, with sides glabrous and angles thickened to winged and puberulent and/or scaberulous (var. *corymbosa*) or terete to flattened and sparsely to densely scaberulous to puberulent throughout (var. *tereticaulis*). Leaves sessile; blade drying membranous, linear, narrowly lanceolate, or narrowly elliptic, 0.8–2 × 0.1–0.5 cm, adaxially sparsely scaberulous to glabrescent, abaxially glabrescent, base cuneate to acute, margins usually at least shortly revolute at least when dry, apex acute; secondary veins not visible; stipules fused to petiole bases, tubular, 1–2 mm, puberulent to glabrous, rounded to triangular, with 1–5 (or 7) linear lobes or bristles 0.2–2.5 mm, these sometimes bifid. Inflorescence axillary, 1-flowered or usually cymose and 2–5-flowered, glabrous, pedunculate; peduncles 1 (or 2) per axil, filiform, 1–16 mm; bracts lacking or stipuliform and 1–1.2 mm; pedicels slender, 2–12 mm. Flowers homostylous, pedicellate. Calyx glabrous to puberulent; hypanthium portion subglobose to narrowly ellipsoid, 0.5–0.8 mm; limb lobed essentially to base; lobes narrowly triangular, 0.5–1.2 mm, entire to ciliate. Corolla white or pink, funnelliform to rotate; tube 0.8–1 mm, inside pubescent or glabrous; lobes spatulate-oblong to narrowly triangular, 0.5–0.8 mm. Anthers included, ca. 0.6 mm. Stigma 0.3–0.5 mm, included. Fruit capsular, subglobose, ovoid, or oblate, 1.2–2 × 1.2–2.2 mm, somewhat dicocous, membranous, glabrous to puberulent, loculicidally dehiscent through flat to broadly rounded apex, beak when present to 0.5 mm, peduncles and pedicels usually elongating rapidly and markedly as fruit develop; seeds 20 or more, dark brown, angled, smooth. Fl. and fr. almost year-round.

Paddy fields, ridges of farmlands, humid grasslands; sea level to 900 m. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Sichuan, Taiwan, Zhejiang [Africa and tropical Asia; widely adventive in the Americas and the Pacific region].

These plants are low annual weeds found in highly disturbed habitats and show wide morphological variation between sites and usually among plants in one site in plant size, leaf width, number of peduncles per axil, and number of flowers per peduncle. The taxonomy of this and related species is complicated, and different authors have drawn very different conclusions (e.g., Sivarajan & Biju, Taxon 39: 665–674. 1990; Dutta & Deb, Taxon. Rev. *Hedyotis*. 2004). In particular, *Hedyotis brachypoda*, *H. diffusa*, and *H. erecta* are related and have been variously circumscribed. Here, these species are circumscribed generally

though not completely following Sivarajan and Biju (loc. cit.) and W. C. Ko (in FRPS 71(1): 72, 75. 1999). However, W. C. Ko described the hypanthium of *H. corymbosa* as 1–1.2 mm in diam., which corresponds to *H. diffusa* in most recent classifications rather than *H. corymbosa*. The varieties recognized by W. C. Ko are presented here for reference.

- 1a. Stems quadrangular, glabrous to pubescent and/or scaberulous along angles ..... 22a. var. *corymbosa*  
 1b. Stems terete to flattened, farinose puberulent throughout ..... 22b. var. *tereticaulis*

**22a. *Hedyotis corymbosa* var. *corymbosa***

伞房花耳草(原变种) *san fang hua er cao* (*yuan bian zhong*)

*Oldenlandia corymbosa* Linnaeus, Sp. Pl. 1: 119. 1753;  
*Pharaceum incanum* Loureiro.

Stems quadrangular, glabrous to pubescent and/or scaberulous along angles. Fl. and fr. almost year-round.

Paddy fields, ridges of farmlands, humid grasslands. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Sichuan, Zhejiang [Africa, America, tropical Asia].

**22b. *Hedyotis corymbosa* var. *tereticaulis*** W. C. Ko, Fl. Hainan. 3: 580. 1974.

圆茎耳草 *yuan jing er cao*

*Hedyotis burmanniana* Wight & Arnott (1834), not Schultes (1827); *H. pseudocorymbosa* Bakhuizen f.; *Oldenlandia pseudocorymbosa* (Bakhuizen f.) Raizada.

Stems terete to flattened, farinose puberulent throughout. Fl. and fr. almost year-round.

• Ridges of farmlands, humid open fields. S and SW China.

This variety may correspond to *Hedyotis diffusa* as circumscribed by Sivarajan and Biju (loc. cit.) and to *H. pseudocorymbosa* as circumscribed by some other authors (e.g., Bakhuizen f., Fl. Java 2: 286. 1965; Dutta & Deb, loc. cit.).

**23. *Hedyotis cryptantha*** Dunn, Bull. Misc. Inform. Kew 1912: 367. 1912.

闭花耳草 *bi hua er cao*

*Oldenlandia cryptantha* (Dunn) Chun.

Herbs, perennial, procumbent, to 50 cm tall; stems 4-angled, sulcate, glabrous to puberulent, sometimes with wings to 4 mm wide. Leaves sessile to petiolate, sometimes clustered near top of stem; petiole to 15 mm; blade with midrib often purple, drying papery, elliptic, oblanceolate, or obovate, 15–30 × 5–10 cm, glabrous (but sometimes when dry appearing puberulent due to collapsed large epidermal cells), base acute to attenuate and long decurrent, apex acute to long acuminate; secondary veins 5–7 pairs, sometimes with well-developed intersecondary veins; stipules interpetiolar, narrowly triangular, 8–30 mm, glabrous, lacinate or with 5 to numerous setiform segments or lobes 1–20 mm, these sometimes apparently glandular at apex. Inflorescences axillary at nodes well below stem apex, capitate, subcapitate, or congested-cymose, 1.5–2.5 cm in

diam., several to many flowered, glabrous, sessile; bracts linear-lanceolate, 5–8 mm, acute to erose or shortly lacinate. Flowers sessile or subsessile, biology unknown. Calyx glabrous; hypanthium portion subglobose, ca. 2 mm; limb lobed essentially to base; lobes linear-lanceolate, 6–8 mm. Corolla white to pale purple, salverform or tubular, outside apparently glabrous; tube 14–16 mm, inside tomentulose from above middle to throat; lobes narrowly ovate, ca. 3 mm. Anthers included, 1–1.2 mm. Fruit indehiscent, obovoid, laterally somewhat flattened, ca. 3 × 2 mm, glabrous, with calyx lobes to 10 mm; seeds angled, black, foveolate. Fl. Sep–Nov, fr. Oct–Jan.

• Forests in humid shady valleys, rock crevices at streamsides; 300–1000 m. Hainan (Lingshui).

**24. *Hedyotis dianxiensis*** W. C. Ko, J. S. China Agric. Univ. 16(4): 44. 1995.

滇西耳草 dian xi er cao

Herb, climbing to scandent; stems flattened to subterete, often angled and/or sulcate, densely villous and usually also tomentose. Leaves petiolate; petiole 1–2.5 mm, densely villous or tomentose; blade drying papery, lanceolate, lanceolate-elliptic, or narrowly ovate, 2–9 × 0.6–3 cm, adaxially moderately to densely hispidulous with pubescence denser on principal veins, abaxially densely pilosulous to hirtellous throughout, base cuneate to rounded, apex acute to long acuminate; secondary veins 3–5 pairs; stipules interpetiolar, broadly rounded to truncate, 1–3.5 mm, densely villosulous or pilosulous, with 3–9 bristles or linear lobes 1–6 mm. Inflorescences terminal and in axils of uppermost leaves, capitate, subcapitate, or glomerulate, densely pilosulous or hirtellous, sessile or pedunculate; peduncle 2–12 mm; heads 1–10, solitary or borne separately along peduncles or axes, each subglobose, 1–2 cm in diam., 15–30-flowered; bracts reduced. Flowers sessile or subsessile, distylous. Calyx with hypanthium portion turbinate to subglobose, ca. 1 mm, densely hispid; limb deeply lobed; lobes spatulate-oblong, triangular, or lanceolate, 1.2–2 mm, hispidulous to glabrescent. Corolla yellowish green, funnellform, outside glabrous to pilosulous, inside densely bearded in throat and onto lobes; tube ca. 2 mm; lobes spatulate-oblong to triangular, ca. 4 mm. Anthers 0.8–1.2 mm, exserted or included. Stigma 0.5–0.8 mm, exserted or included. Fruit capsular, subglobose to obovoid, 3.5–4 mm, pilosulous or hirtellous, cartilaginous, septically then later loculicidally dehiscent, with conical beak ca. 1 mm; seeds several, angled. Fl. Feb–May, fr. Jun.

• Humid thickets at streamsides; 600–800 m. Yunnan (Xishuangbanna).

Although all specimens seen of this species are pubescent, which agrees with the descriptions available, it is keyed out here also with glabrescent stems in case glabrous individuals are eventually found, as in most pubescent Rubiaceae species.

**25. *Hedyotis diffusa*** Willdenow, Sp. Pl. 1: 566. 1798.

白花蛇耳草 bai hua she er cao

*Hedyotis herbacea* Loureiro (1790), not Linnaeus (1753); *Oldenlandia diffusa* (Willdenow) Roxburgh; *O. herbacea* (Linnaeus) Roxburgh var. *uniflora* Benth.

Slender herbs, annual, ascending to procumbent, to 50 cm

tall; stems slightly flattened to terete or young stems sometimes 4-angled, sparsely to densely puberulent, scaberulous, or glabrescent to glabrous, similarly glabrous or pubescent on angles and to sides. Leaves sessile or subsessile; blade drying membranous, linear, narrowly elliptic, or narrowly oblanceolate, 1–4 × 0.1–0.4 cm, adaxially glabrous and smooth or often scaberulous near margins, abaxially glabrous to scaberulous, base acute, margins usually revolute at least when dry, apex acute; secondary veins not visible; stipules fused to petiole bases, triangular to truncate, 0.5–1.5 mm, glabrescent, acute to aristate or with 1–3 bristles 0.2–1 mm. Inflorescences axillary, 1-flowered or fasciculate and 2-flowered, glabrous, pedunculate; peduncles or pedicels 4–20 mm; bracts none or stipuliform, to 1 mm. Flowers pedicellate, apparently homostylous. Calyx glabrous; hypanthium portion subglobose, 1–1.2 mm; limb lobed essentially to base; lobes narrowly triangular, 1–2 mm, ciliate. Corolla white, tubular, outside glabrous; tube 1.5–2.5 mm, glabrous inside; lobes ovate-oblong, 1.2–2 mm. Anthers ca. 0.8 mm, exserted. Stigma ca. 1.2 mm, exserted. Fruit capsular, compressed globose to oblate, 2–3 × 2–3 mm, sometimes somewhat dicocous, membranous, glabrous, loculicidally dehiscent on flat to beaked top, beak rounded, to 0.5 mm, with peduncles elongating rapidly and markedly as fruit mature, to 20 mm; seeds ca. 20, dark brown, angled, deeply thickly foveolate. Fl. and fr. May–Oct.

Paddy fields, ridges of farmlands, humid open fields; sea level to 900 m. Anhui, Fujian, Guangdong, Guangxi, Hainan, Taiwan, Yunnan, Zhejiang [Bangladesh, Bhutan, Indonesia, Japan, Malaysia, Nepal, Philippines, Sri Lanka, Thailand].

This species is very commonly collected in China. The taxonomy of this and related species is complicated, and different authors have drawn very different conclusions (e.g., Sivarajan & Biju, Taxon 39: 665–674. 1990; Dutta & Deb, Taxon. Rev. *Hedyotis*. 2004). In particular, *Hedyotis brachypoda*, *H. corymbosa*, and *H. erecta* are related and have been variously circumscribed. Here, these species are circumscribed generally, though not completely, following W. C. Ko (in FRPS 71(1): 72, 75. 1999) and Dutta and Deb.

**26. *Hedyotis effusa*** Hance, J. Bot. 17: 11. 1879.

鼎湖耳草 ding hu er cao

*Oldenlandia effusa* (Hance) Kuntze.

Herbs or subshrubs, perennial, erect, to 1 m or taller; stems rounded, flattened, or 4-angled, glabrous. Leaves subsessile to petiolate; petiole to 5 mm, glabrous; blade drying papery or leathery, ovate, ovate-lanceolate, or lanceolate-elliptic, 4–13 × 1.5–6.5 cm, glabrous, base cuneate to rounded, apex acute; secondary veins indistinct; stipules united around stem, broadly triangular or truncate, 1–3 mm, glabrous, entire, sometimes partially costate, acute to mucronate. Inflorescences terminal, compound-cymose to paniculate, 5–15 × 4–10 cm, glabrous, several to many flowered, pedunculate; peduncles 2–7 cm; axes regularly dichotomous, spreading at 90° or more; bracts triangular to linear, 0.5–5 mm; pedicels 2–5 mm. Flowers pedicellate. Calyx glabrous; hypanthium portion ovoid, 0.7–1 mm; limb 0.5–0.8 mm, lobed for 1/2–2/3, lobes triangular. Corolla white, funnellform to tubular, outside glabrous; tube ca. 1.5 mm, apparently barbate in throat; lobes narrowly triangular, ca. 1.5 mm. Anthers and stigmas not seen. Fruit capsular, subglobose, 1.5–

2.5 mm, glabrous, stiffly papery to cartilaginous, septically then loculicidally dehiscent; seeds several, angled. Fl. Jul–Sep, fr. Aug–Mar.

• Forests or streamsides in valleys, sometimes on humid hill slopes; 200–400 m. Guangdong, Guangxi.

**27. *Hedyotis exserta*** Merrill, Lingnan Sci. J. 13: 72. 1934.

长花轴耳草 chang hua zhou er cao

Herbs or subshrubs, erect, perennial, to 70 cm; stems terete to flattened, smooth or sulcate, glabrous. Leaves petiolate; petiole 2–5 mm, puberulent; blade drying papery, lanceolate, narrowly elliptic, or narrowly lanceolate, 5.5–11 × 0.8–3 cm, adaxially glabrous or papillose at least near margins, abaxially glabrous, base cuneate to acute, apex acute to long acuminate; secondary veins 4–6 pairs but indistinct; stipules fused to petiole bases, triangular to broadly triangular, 3–8 mm, glabrous or papillose-puberulent, smooth or costate, entire or serrulate, acute to caudate-acuminate. Inflorescences terminal and in uppermost leaf axils, congested-cymose, fastigiate to subglobose, 2–3 cm, densely puberulent, several to many flowered, pedunculate; peduncle 5.5–9 cm; bracts triangular, oblong-ovate, or narrowly elliptic, 0.8–6 mm; pedicels 1–2 mm. Flowers pedicellate. Calyx densely papillose or farinose puberulent; hypanthium portion turbinate, 1–1.5 mm; limb deeply lobed; lobes oblong-ovate to triangular, 1–1.8 mm. Corolla purple or pink, salverform, outside farinose puberulent; tube 7–10 mm, inside pilose; lobes oblong-ovate, 1.2–2 mm. Anthers positioned in throat. Stigmas included, positioned near middle of corolla tube, ca. 2 mm. Fruit capsular, subglobose to ellipsoid and somewhat laterally flattened, 2–2.5 mm in diam., puberulent, flat on top, dehiscent; seeds several, blackish brown, angled. Fl. May–Sep.

Slopes or thickets in valleys. Hainan [Vietnam].

**28. *Hedyotis hainanensis*** (Chun) W. C. Ko, Fl. Hainan. 3: 580. 1974.

海南耳草 hai nan er cao

*Oldenlandia hainanensis* Chun, Sunyatsenia 1: 311. 1934, based on *Hedyotis oligantha* Merrill, Philipp. J. Sci. 23: 266. 1923, not Merrill (1921).

Shrubs, erect, to 30 cm tall; stems terete, densely puberulent to pilosulous. Leaves subsessile to petiolate; petiole to 2 mm, densely puberulent to pilosulous; blade drying papery, subelliptic, broadly elliptic, or ovate, 1–2.5 × 0.8–1.5 cm, adaxially glabrous, abaxially densely puberulent at least along midrib, base obtuse to cuneate, margins sometimes thinly revolute when dry, apex obtuse, acute, or shortly acuminate; secondary veins ca. 3 pairs but indistinct; stipules fused to petiole bases, triangular or ovate, ca. 0.5 mm, puberulent to pilosulous, with 3 short narrow lobes. Inflorescences terminal and also in axils of uppermost leaves, capitate or 2-flowered, sessile. Flowers sessile. Calyx sparsely puberulent; hypanthium portion ovoid, ca. 2 mm; limb lobed nearly to base; lobes 5, narrowly lanceolate, 3–3.5 mm. Corolla blue or white, funnellform, outside glabrous; tube ca. 8 mm, bearded in throat; lobes 5, oblong-lanceolate, ca. 4 mm. Anthers 5, included, ca. 1.8 mm. Stigmas not seen. Fruit not seen. Fl. May–Jun.

• Dense forests. Hainan (Ding'an).

The protologue did not describe the fruit; these were described by W. C. Ko (in FRPS 71(1): 62. 1999, modified to format here) as "Fruit capsular, globose, laterally flattened, ca. 2 mm in diam., sparsely hispidulous, septically dehiscent then loculicidally dehiscent, with persistent calyx lobes" with the same fruiting period as the flowers. However, this description exactly matches the fruit of a group of plants that have been included in *Hedyotis hainanensis* but do not match the type and are provisionally separated here.

**29. *Hedyotis hedyotide*** (Candolle) Merrill, Lingnan Sci. J. 13: 48. 1934.

牛白藤 niu bai teng

*Spermacoce hedyotide* Candolle, Prodr. 4: 555. 1830; *Hedyotis esquirolii* H. Léveillé; *H. macrostemon* Hooker & Arnott; *H. nantoensis* Hayata; *H. recurva* Benth; *Oldenlandia esquirolii* (H. Léveillé) Chun; *O. macrostemon* (Hooker & Arnott) Kuntze.

Shrubs or subshrubs, lianescent, clambering, scandent, or climbing, to 5 m; stems flattened to subterete then often later 4-angled, densely papillose to farinose puberulent or velutinous-strigillose. Leaves petiolate; petiole 1–10 mm, densely papillose, puberulent, or strigillose; blade drying membranous to papery, elliptic-oblong, lanceolate, elliptic, or ovate, 4–10 × 1.5–4 cm, adaxially glabrous or densely papillose to puberulent on principal veins, abaxially glabrous or densely papillose to puberulent or occasionally velutinous-strigillose, base cuneate to rounded, apex acute or shortly acuminate; secondary veins 3–5 pairs; stipules fused to petioles, truncate to broadly rounded, 1.8–3 mm, glabrous to densely papillose, puberulent, or velutinous-strigillose, entire to densely ciliolate and/or with 3–7 narrowly triangular to linear lobes or bristles 1–7 mm, at least sometimes gland-tipped. Inflorescences terminal and in axils of uppermost leaves, subcapitate, congested-cymose, compound-cymose, or paniculate, 1–16 cm, several flowered, with 1–10 congested to laxly cymose groups of flowers, densely granular-puberulent to tomentulose-velutinous, pedunculate; peduncles 0.5–2.5 cm; flower groups subglobose to hemispherical, 1–1.5 cm in diam. (not including corollas), 1.8–3 cm in diam. (including corollas); bracts triangular, narrowly elliptic, or narrowly lanceolate, 0.2–2 mm; pedicels 0.8–2 mm. Flowers pedicellate, distylous. Calyx densely puberulent; hypanthium portion turbinate, 1–1.2 mm; limb 2–2.5 mm, lobed essentially to base; lobes linear-lanceolate to spatulate, usually reflexed at anthesis. Corolla white to pale yellow, tubular to funnellform, outside glabrous, inside densely bearded in throat and onto lobes; tube 2–3 mm; lobes narrowly lanceolate to narrowly spatulate, 4–4.5 mm. Anthers exserted or long exserted, 1.2–2 mm. Stigmas exserted or long exserted, 0.8–1 mm in long-styled form, ca. 2 mm in short-styled form. Fruit capsular, subglobose, obovoid, or oblong-ellipsoid, 2.5–3 mm, densely puberulent to glabrescent, cartilaginous to very stiffly papery, loculicidally then septically dehiscent through apical beak, beak 0.5–1 mm; seeds several, angled. Fl. and fr. Apr–Dec.

Thickets in ravines, hill slopes; 200–1000 m. Fujian, Guangdong, Guangxi, Guizhou, ?Hainan, Taiwan, Yunnan [Cambodia, Thailand, Vietnam].

The flowers appear to be sessile in heads, but closer study shows they are shortly pedicellate. W. C. Ko (in FRPS 71(1): 67. 1999) de-

scribed the leaves as scabrous above, but this has not been seen nor reported by other authors. Ko also described the anthers of the long-styled flowers as included within the corolla, but they are all distinctly exerted on the specimens studied; this character has not been specifically described by other authors.

W. C. Ko (loc. cit.) said that this species was treated as "*Hedyotis fruticosa*" by Kuntze (Obs. 2: 8. 1781), but in fact Kuntze's name was not applied to the same species described by Linnaeus. The name *H. nantoensis* was overlooked by the Fl. Taiwan (ed. 2, 4: 265–273. 1998) but seems to be validly published and clear as to its identity. Fukuoka (S. E. Asia Stud. 8(3): 326. 1970) reported this species from Hainan based on plants here treated as *H. obliquinervis*, which he treated as a variety of *H. hedyotidea*.

**30. *Hedyotis herbacea*** Linnaeus, Sp. Pl. 1: 102. 1753.

丹草 dan cao

*Hedyotis heyinii* (G. Don) Beddome; *Oldenlandia herbacea* (Linnaeus) Roxburgh; *O. heyinii* G. Don.

Herbs, annual or biennial, generally erect, to 60 cm; stems weakly to sharply 4-angled, glabrous to scaberulous at least on angles. Leaves sessile or subsessile; blade linear or linear-lanceolate, 1–2.5 × 0.1–0.3 mm, glabrous to scaberulous, base acute to obtuse, margins weakly to strongly revolute, apex acute; secondary veins not visible; stipules reduced or fused to petiole bases, glabrous to scaberulous, truncate to broadly triangular, to 0.3 mm, entire or with 1–5 triangular to linear lobes or bristles 0.2–2 mm. Inflorescences axillary, 1-flowered or several flowered and fasciculate to cymose, glabrous, apparently ebracteate, pedunculate; peduncles 1–3 per axil, 1–30 mm; pedicels 1–30 mm. Flowers homostylous or heterostylous, subsessile to pedicellate. Calyx glabrous to puberulent; hypanthium portion subglobose to ovoid, 0.8–1 mm; limb lobed essentially to base; lobes narrowly triangular to linear, 0.5–1.5 mm. Corolla white to reddish or pale purple, funnellform, outside glabrous; tube 2–3 mm, glabrous at throat; lobes spatulate-oblong, 0.5–1 mm. Anthers exerted or included, 0.2–0.4 mm. Stigma ca. 0.8 mm, included or exerted. Fruit capsular, ovoid to subglobose, 2–2.5 × 2–2.5 mm, loculicidally dehiscent through apical beak 1–1.5 mm; seeds several, dark brown, foveolate. Fl. and fr. Jan, Mar–Apr.

On humid rocks. Fujian, Guangdong, Guangxi, Hainan, Jiangxi [widespread in tropical Africa and Asia].

Very few specimens have been seen of this species from China (or anywhere else east of Sri Lanka); the description here, therefore, is based primarily on plants from India. W. C. Ko (FRPS 71(1): 73. 1999) described the hypanthium as 1.8–2 mm, the calyx lobes as 2.5–2.8 mm and fimbriate-serrulate, the corolla lobes as ca. 2 mm, and the anthers as ca. 1.5 mm, but these features do not agree with specimens of *Hedyotis herbacea*; they do apply to the rather similar species *H. brachypoda* and *H. diffusa*.

**31. *Hedyotis hermanniana*** R. M. Dutta, J. Econ. Taxon. Bot. 23: 734. 1999.

赫尔曼耳草 he er man er cao

Herbs, annual or perennial, erect to procumbent, to 15(–20) cm tall; stems subterete to angled or sulcate, glabrous. Leaves subsessile to petiolate; petiole to 2 mm; blade drying papery, ovate, lanceolate, or elliptic, 1–2.5(–5) × 0.5–1.5 cm,

adaxially sparsely or moderately hispidulous to glabrescent, abaxially glabrous, base acute to obtuse, margins scaberulous, apex obtuse to acute; secondary veins 2 or 3 pairs but mostly indistinct; stipules fused to petiole bases, broadly triangular, 0.5–1.5 mm, hirtellous or puberulent to glabrescent, rounded to truncate, sometimes apiculate or with 2 or 3 bristles to 1 mm. Inflorescences terminal and in axils of uppermost leaves, fasciculate to loosely dichasial, few flowered, glabrous; peduncles and/or pedicels 2–15 cm; bracts reduced or triangular to setiform, to 1 mm. Flowers pedicellate or pedunculate, floral biology unknown. Calyx glabrous; hypanthium obconic, ca. 1 mm; limb lobed nearly to base; lobes ovate, ca. 1.2 mm, sometimes with evident venation, ciliolate. Corolla white sometimes tinged with pink, salverform, outside glabrous; tube ca. 1.5 mm, inside glabrous; lobes ovate, ca. 0.5 mm. Anthers and stigmas not seen. Fruit capsular, oblate-cupuliform, 2.5–3 × 3.5–4 mm, glabrous, smooth, loculicidally dehiscent across top then sometimes septicial, with beak to 1 mm, with calyx lobes becoming elliptic to ovate, to 2 mm; seeds numerous, subglobose.

Mountains; ca. 1600 m. Yunnan [India, Sri Lanka].

The description here is based on Chinese material. Dutta and Deb (Taxon. Rev. *Hedyotis*. 2004) described the corolla of *Hedyotis hermanniana* in India as having tubes 3–4 mm and lobes 1.5–2 mm, although their figure shows a corolla with a tube slightly over 1 mm and the lobes ca. 2 mm.

**32. *Hedyotis koana*** R. J. Wang, Acta Phytotax. Sin. 45: 696. 2007.

蕴璋耳草 yun zhang er cao

Herbs, erect, to 40 cm tall; stems 4-angled to terete, glabrous. Leaves sessile; blade drying subleathery, linear, 1.4–4 × 0.1–0.15 cm, glabrous, base cuneate, margins revolute, apex acute; secondary veins not visible; stipules fused to petiole bases, triangular, 1–1.8 mm, glabrescent, with 1–3 bristles 0.5–1 mm. Inflorescences terminal and sometimes in uppermost leaf axils, cymose, 2–12-flowered, glabrous, pedunculate; axes ascending; bracts narrowly lanceolate, 1–5 mm, acute to aristate; pedicels 3–20 mm. Flowers pedicellate, biology unknown. Calyx glabrous; hypanthium ovoid to subglobose, 1–1.5 mm; limb deeply lobed; lobes triangular to lanceolate, 1–1.7 mm, acute to acuminate. Corolla white, tubular, glabrous outside; tube 1.5–2.5 mm, glabrous inside; lobes elliptic-oblong to lanceolate, 0.9–1.2 mm. Fruit capsular, subglobose to ovoid, 1.2–2 × 2–3 mm, glabrous, stiffly papery, loculicidally dehiscent from top; seeds several, angled. Fl. and fr. Jun–Sep.

• Weedy open areas; sea level to 200 m. Fujian, Guangdong, Guangxi, Hainan, Hunan, Jiangxi.

**33. *Hedyotis lianshanensis*** W. C. Ko, J. S. China Agric. Univ. 16(4): 41. 1995.

连山耳草 lian shan er cao

Subshrubs, erect, to 80 cm tall; stems hollow, 4-angled to terete, smooth or sulcate, glabrous or usually sparsely hispidulous to puberulent just below stipules when young. Leaves subsessile to petiolate; petiole 3–5 mm, glabrous; blade drying papery, narrowly elliptic-oblong, narrowly elliptic, lanceolate, or ovate, 6–12 × 1.5–4 cm, glabrous or rarely scaberulous adax-

ially along midrib, base cuneate to acute and usually decurrent, apex acute to long acuminate; secondary veins 4 or 5 pairs; stipules fused to petiole bases, obovate, elliptic, or triangular, 3–6 mm, glabrous or puberulent when young, lacerate or with 7 to numerous narrow lobes or bristles 0.5–7 mm, these often glandular at apex. Inflorescence axillary, glomerulate, subglobose, 5–15 mm in diam., glabrous, sessile; bracts narrowly triangular to linear, 1–2 mm. Flowers sessile to subsessile, biology unknown. Calyx glabrous to puberulent; hypanthium portion cupulate to subglobose, 1–1.2 mm; limb lobed essentially to base; lobes lanceolate, narrowly triangular, narrowly ligulate, or linear, 1.5–3 mm, ciliolate. Corolla funnellform, outside glabrous; tube 1.8–2 mm, glabrous inside; lobes lanceolate to triangular, 1–2.5 mm. Anthers partially exerted. Stigmas exerted. Fruit indehiscent, ellipsoid to subglobose, 1.2–2 mm, glabrescent, with pedicels to 2 mm; seeds numerous, angled. Fl. Feb–Jul, fr. Jul–Dec.

- Sparse forests in valleys; 200–700 m. Guangdong (Liangshan).

The protologue described the flowers as shortly pedicellate, but on the specimens studied they are sessile at anthesis with the pedicels or stipes elongating as the fruit develop. W. C. Ko (in FRPS 71(1): 41. 1999) described the fruit as sometimes dehiscent across the top, but the protologue described them as indehiscent, which agrees with the specimens studied.

**34. *Hedyotis lineata*** Roxburgh, Fl. Ind. 1: 369. 1820.

东亚耳草 dong ya er cao

*Exallage ulmifolia* (Wallich) Bremekamp; *Hedyotis ulmifolia* Wallich; *Oldenlandia lineata* (Roxburgh) Kuntze.

Herbs or subshrubs, annual or perennial, clambering or perhaps erect, to 35 cm tall; stems 4-angled, flattened, or subterete, sometimes sulcate, densely villous, hirsute, or pilose with trichomes drying yellowed. Leaves sessile or petiolate; petiole to 3 mm, hirsute or villous; blade drying papery, ovate-lanceolate, elliptic-lanceolate, or elliptic, (0.5–)1.5–3.5(–4) × 1.2–4.5 cm, adaxially sparsely to moderately strigillose to strigose on blade and densely pilosulous on principal veins, abaxially glabrescent on blade and moderately to densely strigose to pilose on principal veins, base obtuse to rounded, apex acute to shortly acuminate; secondary veins 3 or 4 pairs; stipules interpetiolar or fused to petiole bases, broadly triangular to subtruncate, 2–4 mm, densely villous to pilose, with 3 or 5 linear lobes or bristles 2–7 mm. Inflorescences axillary, congested-cymose to fasciculate or subglomerulate, subglobose, 5–15 mm in diam., several flowered, subsessile to pedunculate; peduncles several in each axil, 0.5–4 mm; bracts linear, 1–2 mm; pedicels to 2 mm. Flowers subsessile to pedicellate, biology unknown. Calyx hirtellous; hypanthium portion subcupulate to obconic, ca. 0.8 mm; limb deeply (but not completely) lobed; lobes triangular, 1–1.2 mm. Corolla white, salverform to rotate, outside glabrous except lobes pilose at tip; tube 1–1.5 mm, pubescent in throat; lobes triangular, 1–1.5 mm. Anthers 0.5–0.8 mm, exerted. Stigma 0.3–0.5 mm. Fruit indehiscent, subglobose to turbinate, 1–1.2 × 1.5–2 mm, hirtellous; seeds 36–40, 0.8–1 mm. Fl. Jun, perhaps Nov, fr. Nov.

Broad-leaved forests at high elevations; [100–1100 m in India]. Yunnan (Menghai) [Bangladesh, India, Myanmar, Nepal].

The names *Hedyotis ulmifolia* and *H. lineata* appear to have been published simultaneously; the basis for choosing the name *H. lineata* is not explained in the references consulted but seems to be consistent usage (e.g., Fl. Bhutan 2(2): 761. 1999; Dutta & Deb, Taxon. Rev. *Hedyotis*. 2004).

We have seen no corollas, anthers, or stigmas from China; the description of these parts here is from Dutta and Deb (loc. cit.). W. C. Ko (in FRPS 71(1): 34. 1999) described the corolla tube as 3 × as long as the lobes, which does not agree with the information given by any other authors for this species. Also the elevational range of “at high elevations” given for this species by Ko contrasts markedly with information on the specimens seen and the low to middle elevations noted by other authors.

**35. *Hedyotis loganioides*** Bentham, Fl. Hongk. 149. 1861.

粤港耳草 yue gang er cao

*Oldenlandia loganioides* (Bentham) Kuntze.

Herbs, erect, perennial, to 30 cm tall; stems terete, weakly angled, or weakly flattened, glabrous. Leaves subsessile to petiolate; petiole 0.5–4 mm, glabrous to puberulent; blade drying papery, elliptic-oblong, lanceolate, or elliptic, 1.5–6 × 1–3.5 cm, glabrous, base acute to cuneate, apex acute to shortly acuminate; secondary veins 3–5 pairs but hardly visible; stipules apparently interpetiolar, ovate-triangular to lanceolate, 2–2.5 mm, puberulent to glabrous, entire to shortly ciliolate, obtuse to rounded. Inflorescences axillary, cymose, 0.8–2 cm, sometimes trichotomous and compact, 10–20-flowered, glabrous; peduncles 2–10(–20) mm; bracts triangular to narrowly triangular, 0.5–3.5 mm; pedicels 1–2 mm. Flowers pedicellate, floral biology unknown. Calyx glabrous; hypanthium portion subglobose to flattened-ovoid, ca. 1 mm; limb lobed nearly to base; lobes linear to narrowly triangular, 1.5–2.2 mm. Corolla outside glabrous. Fruit capsular, ellipsoid to subglobose, ca. 2 × 2–2.3 mm, glabrous, cartilaginous to stiffly papery, smooth, apparently septicidal then loculicidal, beak broadly triangular to conical, up to 0.5 mm; seeds few. Fr. Dec.

- Guangdong.

**36. *Hedyotis longixserta*** Merrill & F. P. Metcalf, J. Arnold Arbor. 23: 229. 1942.

上思耳草 shang si er cao

Herbs or subshrubs, erect, to 50 cm tall; stems terete, glabrous, smooth. Leaves petiolate; petiole 3–5 mm, glabrous; blade lanceolate or oblong-lanceolate, 5–7 × 1–1.5 cm, base cuneate or obtuse, apex acuminate or acute; secondary veins ca. 3 pairs but very indistinct; stipules fused to petiole bases, broadly ovate, ca. 3 mm, abruptly narrowed apically to acute, marginally weakly glandular-serrulate. Inflorescences terminal, compound-cymose, 7–12 cm, several to many flowered; secondary axes few, racemiform, 3–4 cm, higher order axes shorter, becoming scorpioid; bracts linear-lanceolate or linear, 0.8–1.2 cm. Flowers pedicellate and/or sessile. Calyx glabrous; hypanthium portion ovoid, 1–1.2 mm; lobes triangular-ovate, ca. 0.5 mm. Corolla white, outside glabrous; tube ca. 1.5 mm, inside densely bearded; lobes broadly ovate, rounded. Fruit capsular, oblong-ellipsoid, 2–2.5 × ca. 1.5 mm, septicidally then loculicidally dehiscent; seeds several, black. Fl. Jun–Jul.

- Dry open fields, mountain slopes. Guangxi (Shangsi).

**37. *Hedyotis longipetala*** Merrill, J. Arnold Arbor. 8: 18. 1927.

长瓣耳草 chang ban er cao

*Oldenlandia longipetala* (Merrill) Chun.

Subshrubs, erect, to 40 cm tall; stems glabrous, terete to 4-angled with angles obtuse to acute or ridged. Leaves sessile to petiolate; petiole to 8 mm, glabrous; blade drying stiffly leathery, narrowly lanceolate, narrowly elliptic, or linear-lanceolate, 3–8 × 0.4–1.2 cm, glabrous and shiny, base cuneate to usually acute and decurrent, margins revolute at least when dry, apex long acuminate; secondary veins indistinct; stipules interpetiolar, triangular, ovate, or oblong-ovate, 3–5 mm, glabrous, shiny and hardened, acute to acuminate. Inflorescence terminal and sometimes in uppermost leaf axils, congested-cymose to subcapitate, flattened-globose, 1.5–2 cm in diam., glabrous, several to many flowered, sessile, subtended by 2 pairs of leaves or leaflike bracts with inner (i.e., distal) pair ca. 1/2 as large as outer (i.e., proximal), or axillary cymes few flowered and without leaflike bracts; floral bracts elliptic to triangular, 2–6 mm; pedicels to 2 mm. Flowers sessile to shortly pedicellate. Calyx glabrous, shiny; hypanthium portion obconic, ca. 1 mm; limb lobed for ca. 1/2; lobes triangular, lanceolate, or spatulate, 2–4 mm. Corolla white, tubular; tube ca. 3.5 mm, pilosulous in throat; lobes lanceolate, ca. 11 mm. Anthers ca. 2 mm. Fruit capsular, ovoid or ellipsoid, 3–4 mm in diam., glabrous, cartilaginous to hard, septicidal then tardily loculicidal; seeds several. Fl. Apr–Jun, fr. Jul–Sep.

- Broad-leaved forests on mountaintops, grasslands at roadsides; ca. 800 m. Fujian, Guangdong.

The dry plants have a yellowish-brownish cast and a distinctive shiny, hardened surface on all parts.

**38. *Hedyotis matthewii*** Dunn, J. Bot. 47: 376. 1909.

疏花耳草 shu hua er cao

*Hedyotis acuminatissima* Merrill; *Oldenlandia matthewii* (Dunn) Chun.

Herbs or subshrubs, erect, perennial, branched, to 75 cm tall; stems terete to 4-angled, glabrous. Leaves subsessile to petiolate; petiole to 8 mm, glabrous; blade drying papery to subleathery, narrowly elliptic, elliptic, or lanceolate, 3.5–12 × 0.8–3 cm, glabrous, base acute to obtuse, apex acute to long acuminate; secondary veins ca. 3 pairs but indistinct; stipules fused to petiole bases, broadly triangular to ovate-triangular, 2–4.5 mm, glabrous, sometimes costate, marginally entire to glandular-serrulate, acute to acuminate and sometimes thickened at apex. Inflorescences terminal and usually also in axils of uppermost leaves, cymose, paniculate, or racemiform, 6–12 × 1.5–7 cm, glabrous, several to many flowered, sessile and apparently tripartite or pedunculate; peduncles 1–4 cm; axes mostly dichotomous; bracts linear-lanceolate, 1–7 mm; pedicels 0.5–4 mm. Flowers subsessile to pedicellate, distylous. Calyx glabrous; hypanthium turbinate or obovoid, 1–1.5 mm; limb 1.5–2.2 mm, lobed for 1/2 to deeply lobed; lobes lanceolate to triangular. Corolla white or purplish, funnelliform, outside gla-

brous; tube 3.5–4 mm, inside pubescent in throat; lobes triangular, 2–3 mm, inside puberulent. Anthers included or exerted, 0.8–1 mm. Stigmas included or exerted, 0.5–1 mm. Fruit capsular, ellipsoid, 2–2.5 mm, crustaceous to cartilaginous, smooth, glabrous, septicidally then loculicidally dehiscent; seeds numerous, black, angled. Fl. Mar–Nov, fr. May–Jul.

- Dense forests or thickets on mountains; 100–300 m. Guangdong.

The circumscription here of this species and in particular its separation from *Hedyotis mellii* differs somewhat from that of some previous authors but provides a more consistent separation of it from *H. mellii* and *H. cantoniensis*.

**39. *Hedyotis mellii*** Tutcher, Rep. Bot. Dept. Hong Kong 1914: 32. 1915.

粗毛耳草 cu mao er cao

*Hedyotis speciosa* Handel-Mazzetti; *H. wulsinii* Merrill; *Oldenlandia mellii* (Tutcher) Chun.

Herbs, erect, perennial, to 90 cm tall; stems subterete to 4-angled, densely to sparsely hirtellous or pilosulous to sometimes glabrescent. Leaves sessile; blade drying papery, ovate-lanceolate, elliptic, lanceolate, or narrowly elliptic, 3.5–9.5 × 0.5–3.5 cm, adaxially sparsely to densely puberulent or hispidulous or often glabrous on lamina, abaxially sparsely to densely hirtellous, pilosulous, or hispidulous to glabrous; secondary veins 3 or 4 pairs; stipules fused to petiole bases, triangular to broadly triangular, 1–3 mm, densely puberulent, hirtellous, or hispidulous to glabrescent, marginally entire to glandular-serrate, acuminate or with 3–5 narrowly triangular to linear lobes or bristles 0.2–2 mm. Inflorescences terminal and usually also in axils of uppermost leaves, cymose to compound-cymose, paniculate to often racemiform, 3–25 cm, several to many flowered, densely to sparsely pilosulous, puberulent, or hispidulous to glabrous; peduncle 0.5–7 cm; bracts narrowly elliptic to narrowly lanceolate, 1–5 mm; pedicels 1–5 mm. Flowers pedicellate, apparently monomorphic. Calyx glabrous or sparsely to densely hirtellous to pilosulous; hypanthium portion cupulate to obconic or elliptic, ca. 1 mm; limb 1–1.5 mm, lobed for 2/3–4/5; lobes ovate-lanceolate to narrowly triangular. Corolla presumably white, funnelliform, outside glabrous to densely hirtellous or pilosulous, inside densely villosulous or tomentulose in throat and onto lobes; tube 2–2.5 mm; lobes lanceolate to spatulate, 4–4.5 mm, acute. Anthers shortly exerted, ca. 1.2 mm. Stigma long exerted, ca. 0.2 mm. Fruit capsular, ellipsoid to subglobose, 2–3 mm, sparsely to densely hirtellous, pilosulous, or glabrous, crustaceous to thickly papery or cartilaginous, septicidally then loculicidally dehiscent; seeds several, black, angled. Fl. Jun–Nov, fr. Aug–Nov.

- Jungles or thickets on mountains or mountain slopes; 400–1100 m. Fujian, Guangdong, Guangxi, Hunan, Jiangxi.

This species is very similar to *Hedyotis cantoniensis*, *H. matthewii*, and *H. tenuipes*, and these are here separated somewhat differently from the circumscriptions of FRPS (71(1): 48, 51, 52, 54. 1999). *Hedyotis matthewii* may be only a glabrous form of *H. mellii*, although they do appear to be distinct.

**40. *Hedyotis merguensis*** Benth. & J. D. Hooker, Gen. Pl. 2: 57. 1873.

合叶耳草 he ye er cao

*Hedyotis connata* J. D. Hooker, nom. illeg. superfl.; *H. coronaria* (Kurz) Craib; *H. coronata* Wallich ex J. D. Hooker & B. D. Jackson, nom. illeg. superfl.; *Oldenlandia connata* K. Schumann, nom. illeg. superfl.; *O. coronata* F. N. Williams, nom. illeg. superfl.; *Scleromitron coronarium* Kurz.

Herbs, perennial or perhaps annual, procumbent; stems to 30 cm, weakly 4-angled to terete, sometimes sulcate, densely pilosulous or hispidulous just below nodes grading to glabrous at bases of internodes. Leaves sessile or subsessile; blade drying membranous or thinly papery, oblong-elliptic or oblong-lanceolate, 2.5–10 × 1–3 cm, glabrous except sometimes puberulent along midrib abaxially and/or scaberulous along margins, base obtuse to rounded, apex obtuse to acute; secondary veins 3–5 pairs; stipules fused to petiole bases, triangular to rounded, 3–4.5 mm, puberulent to glabrescent, ciliolate, with 5–7 linear lobes or bristles 2–12 mm. Inflorescences terminal and/or pseudoaxillary on short lateral stems, capitate, 1–1.5 cm in diam., several flowered, sessile, enclosed by stipules and leaf bases, subtended by 2 or usually 4 leaves; bracts not seen. Flowers sessile or subsessile, apparently distylous. Calyx glabrous; hypanthium portion ellipsoid, ca. 2 mm; limb deeply lobed; lobes lanceolate, oblanceolate, or spatulate, 4–5 mm, distinctly veined, ciliolate. Corolla white tinged with pink or lilac, funnel-form, outside glabrous; tube 9–12 mm, pubescent in throat; lobes lanceolate to triangular, ca. 3 mm. Anthers 1–1.5 mm, exerted or included. Stigma 1–1.5 mm, exerted or included. Fruit indehiscent, ellipsoid to obovoid, 2.2–3 mm, papery, glabrous, with calyx lobes to 5.2 mm; seeds numerous, black, angled or ridged. Fl. [Aug–Oct in Thailand].

Bamboo forests, on rocks at streamsides; 600–1000 m. Hainan, Yunnan (Mengla) [India, Malaysia, Myanmar, Philippines, Thailand, Vietnam].

The widely used name *Hedyotis coronaria* was synonymized with *H. merguensis* by Bakhuizen f. (Fl. Java 2: 286. 1965); this synonymy was accepted by Dutta and Deb (Taxon. Rev. *Hedyotis*. 2004) but overlooked by some other authors.

**41. *Hedyotis minutopuberula*** Merrill & F. P. Metcalf, J. Arnold Arbor. 23: 229. 1942.

粉毛耳草 fen mao er cao

Herbs or subshrubs, to 50 cm tall; stems terete, puberulent. Leaves petiolate; petiole 4–8 mm, puberulent; blade drying submembranous, ovate or elliptic-oblong, 4.5–5 × 0.7–2.5 cm, adaxially glabrous, abaxially glabrous or farinose pubescent, base cuneate or decurrent, apex acute or weakly acuminate; secondary veins ca. 3 pairs but indistinct; stipules ovate or lanceolate, 2–5 mm, marginally glandular-serrulate, long acuminate. Inflorescences terminal, cymose to paniculate, 1.5–4 × 2–4.5 cm; axes dichotomous to subumbelliform; bracts subulate, ca. 2 mm; pedicels ca. 1 mm. Flowers pedicellate. Calyx puberulent; hypanthium portion obovoid, ca. 1 mm; lobes lanceolate to narrowly triangular, 1.5–2.5 mm. Corolla purple, tubular-salverform, outside glabrous; tube ca. 6 mm, bearded in

throat; lobes obovate to triangular, 1–1.2 mm. Anthers included. Fruit capsular, subglobose or obovate, ca. 2 × 1.5 mm, puberulent or subglabrous, dehiscent; seeds 2–4, black, angled. Fl. Apr–Jun.

• Jungles or thickets at low elevations or on slopes of low hills. Hainan.

**42. *Hedyotis obliquinervis*** Merrill, Lingnan Sci. J. 14: 56. 1935.

偏脉耳草 pian mai er cao

*Hedyotis hedyotideae* (Candolle) Merrill var. *obliquinervis* (Merrill) Fukuoka.

Shrubs or subshrubs, climbing to scandent, to 40 cm; stems terete to 4-angled, sometimes sulcate, densely villous and usually also hirtellous or villosulous. Leaves petiolate; petiole 1–5 mm, densely hirtellous or villosulous; blade drying papery, lanceolate, oblong-lanceolate, or lanceolate-elliptic, 3–8 × 0.8–2.5 cm, adaxially sparsely to moderately hispidulous and sometimes villosulous or villous on lamina and densely hispidulous on principal veins, abaxially moderately to densely hispidulous, villosulous, or hirtellous with pubescence denser on principal veins, base cuneate to rounded, apex acute to acuminate; secondary veins 3–5 pairs; stipules fused to petiole bases, densely villous to villosulous, rounded, 1–4 mm, hispidulous, with 3–7 narrowly triangular to linear lobes or bristles 2–7 mm. Inflorescences terminal and sometimes also in axils of uppermost leaves, cymose to corymbiform-rounded, 2.5–9 × 4–16 cm, densely villous, villosulous, or hirtellous or sometimes glabrescent, pedunculate or sessile and tripartite; peduncles 1.5–5 cm; bracts linear-lanceolate to lanceolate, 0.5–4 mm; pedicels 1.5–3 mm. Flowers pedicellate, distylous. Calyx moderately to densely hirtellous or villosulous; hypanthium portion obconical, 1–1.5 mm; limb lobed nearly to base; lobes lanceolate to spatulate, 2–2.5 mm, sometimes reflexed. Corolla white or greenish white, funnel-form, outside subglabrous or hispidulous at least on upper part; tube 1–1.5 mm, bearded in throat; lobes lanceolate to spatulate, 2–2.5 mm. Anthers exerted or included, 0.8–1 mm. Stigmas included or exerted, 0.2–0.5 mm. Fruit capsular, compressed globose, ca. 2 mm in diam., hirtellous or villosulous, cartilaginous, septicidally then loculicidally dehiscent, beak rounded, ca. 0.6 mm high; seeds several, blackish brown, angled. Fl. Dec–Aug, young fr. Jun–Jul.

Broad-leaved forests, thickets on hills; 100–400 m. Hainan [S Vietnam].

This species is very similar to *Hedyotis ampliflora* and may be only a pubescent form of that species.

**43. *Hedyotis ovata*** Thunberg ex Maximowicz, Bull. Acad. Imp. Sci. Saint-Petersbourg 29: 161. 1883.

卵叶耳草 luan ye er cao

*Oldenlandia ovata* (Thunberg ex Maximowicz) Kuntze.

Herbs or subshrubs, erect, perennial, to 90 cm tall; stems 4-angled, glabrous. Leaves petiolate; petiole ca. 5 mm, glabrous; blade drying papery, ovate, 2.5–7 × 1.5–3.5 cm, glabrous, base acute, margins revolute, apex acute; secondary

veins 3 or 4 pairs but indistinct; stipules triangular to broadly triangular, ca. 2 mm, marginally glandular-serrulate. Inflorescences terminal and sometimes also in axils of uppermost leaves, fascicled, several flowered, sessile or pedunculate; peduncles 0.9–2 cm; bracts triangular, ca. 1.5 mm; pedicels 0.5–1 mm. Flowers subsessile to pedicellate. Calyx with hypanthium portion subglobose, 1–1.5 mm in diam.; lobes lanceolate, ca. 4 mm. Corolla purplish red, villosulous in throat and onto lobes; tube 3–4.5 mm. Anthers included. Stigmas included. Fruit capsular, subglobose, 3–4 mm in diam., septically then loculicidally dehiscent; seeds 3 or 4, 4-angled, smooth. Fl. and fr. Apr–Jul.

- On humid soil rich in humus in forests. Hainan (Sanya).

This species has been reported from Vietnam by the Kew Rubiaceae checklist (Govaerts et al., World Checkl. Rubiaceae; <http://www.kew.org/wcsp/rubiaceae/>; accessed on May 2007); it was not included in the Vietnam checklist.

#### 44. *Hedyotis ovatifolia* Cavanilles, Icon. 6: 52. 1801.

矮小耳草 ai xiao er cao

*Gonotheca ovatifolia* (Cavanilles) Santapau & Wagh; *Oldenlandia nudicaulis* Roth; *O. ovatifolia* (Cavanilles) Candolle; *Thecagonum ovatifolium* (Cavanilles) Babu.

Herbs, erect, annual, to 15 cm tall; stems terete to 4-angled, often sulcate, densely villosulous, pilosulous, or puberulent with pubescence denser, longer, and apparently glandular on upper (i.e., distal) parts of internodes. Leaves subsessile to usually petiolate, distributed along stem or those at uppermost 2 nodes clustered or apparently 4-verticillate especially at base of inflorescence; petiole 1–5 mm, densely puberulent to villosulous; blade drying membranous, elliptic or ovate, 1–6 × 0.7–3 cm, adaxially glabrous, abaxially puberulent or villosulous to glabrescent, base cuneate to rounded, apex acute to rounded; secondary veins 3–6 pairs; stipules fused to petiole bases, truncate to broadly rounded, 1–2.5 mm, pilosulous to glabrescent, erose to glandular-lacerate and usually also with 1–3 linear lobes to 1 mm. Inflorescence terminal, cymose to paniculate, 3–10 cm, glabrous, several to many flowered, pedunculate; peduncles 1–3, 1.5–4 cm, slender; axes mostly dichotomous; bracts triangular, 0.1–0.5 mm; pedicels 1–12 mm. Flowers pedicellate. Calyx glabrous; hypanthium portion subglobose, ca. 0.5 mm; limb lobed essentially to base; lobes triangular, 0.2–0.3 mm. Corolla white, tubular or salverform, outside glabrous; tube 1–1.5 mm, barbate in throat; lobes lanceolate, ca. 1 mm. Anthers exserted, ca. 0.2 mm. Stigma ca. 0.6 mm, exserted. Fruit capsular, compressed globose, 2–3 × 2–3 mm, glabrous, loculicidally dehiscent across top through beak, beak broadly rounded, to 0.3 mm high; seeds numerous, smooth. Fl. and fr. Jul–Aug.

Broad-leaved forests or grasslands on mountain slopes, sometimes on limestone rocks. Guizhou, Hainan, Taiwan, Yunnan [India, Malaysia, Nepal, Pakistan, Philippines, Sri Lanka, Thailand].

The measurements of several structures, in particular calyx, corollas, and anthers, given by Dutta and Deb (Taxon. Rev. *Hedyotis*. 2004) and also W. C. Ko (in FRPS 71(1): 71–72. 1999) do not agree with the specimens studied, nor with Dutta and Deb's own figure. The measurements in the description here are taken from specimens, which

agree with Dutta and Deb's figure. All authors have found both the anthers and stigmas exserted (cf. Dutta & Deb figure; *Cooray 69011901R*, MO!) except Fl. Bhutan (2(2): 762–763. 1999), who found the anthers included.

#### 45. *Hedyotis paridifolia* Dunn, Bull. Misc. Inform. Kew 1912: 366. 1912.

延齡耳草 yan ling er cao

*Oldenlandia paridifolia* (Dunn) Chun.

Herbs or subshrubs, perennial, erect, to 30 cm tall; stems green or purplish, flattened to subterete, usually sulcate along each side, glabrous. Leaves subsessile to shortly petiolate, often clustered and apparently verticillate at tops of stems; petiole to 3 mm, glabrous; blade drying papery, ovate, elliptic, or elliptic-ovate, 7–9(–12) × 2.5–4.5 cm, glabrous, base obtuse to rounded and often decurrent, apex acute or shortly acuminate; secondary veins 5–7 pairs; stipules fused to petiole bases, triangular to broadly triangular, 1–3.2 mm, glabrous, sparsely glandular-serrulate or glandular-setulose, apex with aristate projection 1–2 mm. Inflorescences terminal, capitate or subcapitate, hemispherical, 1.5–2.5 cm in diam., glabrous, subsessile; bracts triangular, 1–2 mm; pedicels to 2.5 mm. Flowers shortly pedicellate to sessile, perhaps monomorphic. Calyx glabrous; hypanthium portion purple, turbinate, ca. 1 mm, puberulent; limb lobed nearly to base; lobes on a few flowers rarely 2 or 3, elliptic, elliptic-oblong, or lanceolate (i.e., narrowed at base), 2–4 mm, obtuse to acute. Corolla white, funnelform to tubular, outside glabrous; tube 4–5 mm, inside pilosulous in upper part and throat; lobes triangular, 1–1.2 mm. Anthers exserted, ca. 1 mm. Stigma exserted, ca. 1.2 mm. Fruit indehiscent, straw-yellow, obovoid or subellipsoid, 3–3.5 × 2–2.5 mm, glabrescent; seeds numerous, black, angled, foveolate. Fl. May–Nov, fr. Apr–May.

- Forests or thickets at middle elevations; ca. 200 m. Hainan.

W. C. Ko (in FRPS 71(1): 35. 1999) described the leaf blade as up to 12 cm, but this has not been seen on specimens studied and may include plants that have been subsequently separated as *Hedyotis baotingensis*.

#### 46. *Hedyotis pinifolia* Wallich ex G. Don, Gen. Hist. 3: 526. 1834.

松叶耳草 song ye er cao

*Oldenlandia pinifolia* (Wallich ex G. Don) K. Schumann.

Herbs, annual or perennial, diffusely branched, to 25 cm tall; stems wiry, sharply 4-angled to subterete, sometimes sulcate, glabrous. Leaves sessile or subsessile, sometimes borne on very short axillary stems and appearing verticillate or clustered; blade drying stiffly papery to leathery, linear to narrowly spatulate, 5–25 × 0.8–2 mm, adaxially glabrous to densely scaberrulous, abaxially glabrous, base straight to acute, margins markedly revolute at least when dry, apex acute; secondary veins not visible; stipules shortly fused to petiole bases, triangular to rounded, 0.8–1.2 mm, puberulent to glabrous, with 1–5 linear lobes or bristles 0.5–2.5 mm. Inflorescences terminal and pseudoaxillary on short axillary stems, capitate to shortly fasciculate, 4–7 mm in diam., (1 or)3–10-flowered, sessile and sub-

tended by 1 or 2 pairs of somewhat reduced leaves; bracts lanceolate to setose, 0.5–4 mm, entire to ciliate; pedicels to 1 mm. Flowers sessile, subsessile, or pedicellate, apparently homostylous. Calyx with hypanthium portion obconical to subglobose, 0.8–1.2 mm, glabrous to densely hispidulous; limb lobed for more than 1/2; lobes subulate to narrowly triangular, 1–2 mm, glabrescent, entire to densely ciliolate. Corolla white sometimes flushed with pink, tubular to funnelform, outside glabrous; tube 3–4.2 mm, pubescent in throat; lobes spatulate-oblong to elliptic, 1.8–2 mm. Anthers exserted, ca. 1 mm. Stigma 0.5–1 mm, exserted and positioned above anthers. Fruit capsular, ovoid to lanceoloid, 2.5–3 × 1.5–2 mm, cartilaginous to stiff, loculicidal across top; seeds several to numerous, pale brown, angled. Fl. May–Nov, fr. Apr–Nov.

Open fields on hills, sandy wastelands at seashores or riversides; sea level to below 100 m. Fujian, Guangdong, Guangxi, Hainan, Taiwan, Yunnan [India, Malaysia, Myanmar, Nepal, Thailand, Vietnam].

The plant illustrated in FRPS (71(1): 70, t. 13, f. 1–6. 1999) as "*Hedyotis umbellata*" is actually *H. pinifolia*. The Fl. Bhutan (2(2): 763–764. 1999) included this species noting that the report is based on a published historical record that has not been re-confirmed.

**47. *Hedyotis platystipula*** Merrill, Philipp. J. Sci. 21: 510. 1922.

阔托叶耳草 kuo tuo ye er cao

*Oldenlandia platystipula* (Merrill) Chun.

Herbs or subshrubs, erect to perhaps weak, to 40 cm tall; stems flattened to 4-angled, sometimes sulcate, glabrous. Leaves petiolate; petiole 3–18 mm, glabrous; blade drying membranous, elliptic, oblong-ovate, or oblong-lanceolate, 5–12 × 2.5–4 cm, adaxially glabrous or rarely puberulent along principal veins, abaxially glabrous or papillose on principal veins, base cuneate to rounded and usually shortly decurrent, apex acute to shortly acuminate; secondary veins 4–6 pairs; stipules interpetiolar, reniform, ovate, or suborbicular, 5–10 mm, glabrous, broadly rounded to broadly triangular, fringed-lacerate or with numerous lobes or bristles 0.3–2 mm, usually glandular at apex. Inflorescence axillary, glomerate, subglobose, 1–2.5 cm in diam., glabrous, sessile; bracts not seen. Flowers sessile to subsessile, biology unknown. Calyx glabrous; hypanthium portion turbinate to ellipsoid, 1.2–2 mm; limb lobed essentially to base; lobes narrowly lanceolate to triangular, 4–6 mm, ciliate. Corolla white, tubular, outside glabrous; tube 6–7 mm, inside apparently glabrous; lobes lanceolate to triangular, 1.5–2 mm. Anthers ca. 2 mm, partially exserted. Stigmas ca. 1.5 mm, included. Capsules oblong-ellipsoid to obconic, 2–3 × 1.5–2 mm, somewhat flattened laterally, septicidally then loculicidally dehiscent; seeds ca. 10, black, scabrous. Fl. May–Aug, fr. Sep.

• Forests in valleys, on rocks at streamsides. Guangdong, Guangxi.

**48. *Hedyotis prostrata*** Blume, Catalogus, 40. 1823.

菲律宾耳草 fei lü bin er cao

*Hedyotis congesta* R. Brown ex G. Don; *H. laevigata* (Candolle) Miquel; *H. philippensis* (Willdenow ex Sprengel) Merrill ex C. B. Robinson; *Metabolos laevigatus* Candolle;

*Oldenlandia congesta* (R. Brown ex G. Don) Kuntze (1891), not Baker (1877); *O. prostrata* (Blume) Kuntze; *Spermacoce philippensis* Willdenow ex Sprengel.

Herbs or subshrubs, erect to perhaps clambering, to 60 cm tall; stems 4-angled, flattened, or terete, sometimes sulcate, glabrous. Leaves petiolate; petiole 3–6 mm, glabrous; blade drying papery or membranous, ovate, lanceolate, ovate-lanceolate, or elliptic, 3.2–12 × 1.2–4.5 cm, glabrous, base cuneate, obtuse, or rounded then often decurrent, apex acute or acuminate; secondary veins 4–6 pairs but usually not visible; stipules shortly fused to petiole bases or around stem, broadly triangular, 2–4 mm, glabrous or pilosulous to hirtellous, acute or usually acuminate to aristate, entire or glandular-serrulate. Inflorescence axillary and/or terminal, capitate or glomerulate, 5–10 mm in diam., 10–18-flowered, glabrous, sessile or subsessile; bracts lanceolate, triangular, or linear, 0.5–4 mm. Flowers sessile to subsessile, floral biology unknown. Calyx glabrous; hypanthium portion obconic to campanulate, 0.8–1 mm; limb lobed essentially to base; lobes triangular, 1–1.2 mm. Corolla white to violet, funnelform; tube 2–3 mm; lobes lanceolate, 1–1.2 mm. Fruit indehiscent or tardily septicidal, ellipsoid-oblong to subglobose, 2–4 × 1.5–3 mm, with pedicels to 2 mm; seeds 10–12, black, foveolate. Fl. Apr–Jun.

Thickets; 200–400 m. Hainan (Xinglong) [India, Indonesia, Philippines, Vietnam].

Plants from the Philippines have fruit that are markedly ellipsoid, but the Chinese plants treated under this name have subglobose fruit that are quite distinctively different in shape.

This species has long been treated under the name *Hedyotis philippensis*, based on the conclusion that Blume's valid publication of the name *H. prostrata* was in 1826 while the basionym of *H. philippensis* was published in 1825. However, Bakhuizen f. (Fl. Java 2: 284–288. 1965) noted that Blume's name was actually published in an earlier work and, thus, is the oldest name for this species. Dutta and Deb (Taxon. Rev. *Hedyotis*. 2004) treated this species under the name *H. congesta*, without explanation.

**49. *Hedyotis pterita*** Blume, Bijdr. 972. 1826–1827.

翅果耳草 chi guo er cao

*Gonotheca blumei* Candolle; *Hedyotis alata* Koenig ex Wight & Arnott; *Oldenlandia alata* (Koenig ex Wight & Arnott) J. D. Hooker; *O. pterita* (Blume) Miquel; *Thecagonum pteritum* (Blume) Babu.

Herbs, annual or perennial, at least weakly erect, to 15(–30) cm tall; stems subterete to 4-angled, sometimes sulcate and/or winged, glabrous. Leaves subsessile to petiolate; petiole to 10 mm, glabrous; blade drying membranous, elliptic-oblong, lanceolate, or elliptic, 1–6 × 0.4–1.5 cm, glabrous, base cuneate to obtuse then often abruptly decurrent, apex acute or obtuse; secondary veins indistinct; stipules fused to petiole bases, triangular, 0.5–2.5 mm, glandular-puberulent to glabrescent, apically truncate or serrulate to prolonged and acute. Inflorescences terminal becoming displaced to pseudoaxillary in upper leaf axils by subsequent stem growth, 1-flowered or 2–8-flowered and cymose to fasciculate, glabrous, subsessile or pedunculate; peduncle to 1.5 cm; bracts reduced, triangular, to 0.3 mm; pedicels to 1.5 mm, winged. Flowers subsessile to shortly

pedicellate. Calyx glabrous; hypanthium portion cupular to turbinate, 1–2 mm, with 4 wings to 0.6 mm wide; limb lobed for 1/2–2/3 its length; lobes ovate, ca. 1 mm, reticulately veined, dorsally winged to apex, sometimes ciliolate, acute to acuminate. Corolla white, outside glabrous; tube 1–1.5 mm, barbate in throat; lobes triangular, 1–1.5 mm. Anthers ca. 0.5 mm, included and positioned near base of corolla tube. Fruit capsular, turbinate to ellipsoid, 5–8 × 3–5 mm, glabrous, with 4 wings to 1 mm wide; seeds numerous, ca. 0.5 mm. Fl. Jul–Oct.

Thickets, slightly shaded wastelands. Guangdong, Guangxi [India, Malaysia, Philippines, Thailand, Vietnam].

**50. *Hedyotis pulcherrima*** Dunn, Bull. Misc. Inform. Kew, Addit. Ser. 10: 127. 1912.

艳丽耳草 *yan li er cao*

*Oldenlandia pulcherrima* (Dunn) Chun.

Herbs or subshrubs, perennial, erect, to 30 cm tall; stems terete to slightly flattened, densely farinose puberulent. Leaves petiolate; petiole 0.15–0.6 cm, farinose puberulent; blade drying papery, ovate, lanceolate-elliptic, or lanceolate, 0.8–5 × 0.5–2 cm, both surfaces glabrous or puberulent on midrib, base obtuse to rounded, margins plane to revolute, apex obtuse to acute; secondary veins 3 or 4 pairs but mostly indistinct; stipules fused to petiole bases, broadly triangular to broadly rounded, 1–2 mm, densely farinose puberulent, ciliolate-serrulate, apically sometimes with obtuse to shortly apiculate protuberance. Inflorescences terminal and in axils of uppermost leaves, 1-flowered or 2–4-flowered and fasciculate, densely puberulent, pedunculate; peduncles 2–6 mm, often articulate above middle; bracteoles lanceolate or spatulate, 0.5–2 mm. Flowers pedunculate. Calyx glabrous; hypanthium portion turbinate to ellipsoid, ca. 1.2 mm; limb lobed nearly to base; lobes narrowly lanceolate to narrowly spatulate, 3–3.5 mm. Corolla pale purple, funnelform, outside glabrous; tube 12–13 mm, pubescent in throat; lobes spatulate-oblong to ovate, 4–6 mm. Anthers in apparent short-styled form included or partially exerted, ca. 2 mm. Stigmas included, positioned near middle of corolla tube, ca. 2.3 mm. Fruit capsular, ovoid or obovoid, ca. 2.5 mm, crustaceous to cartilaginous, outside glabrescent, septicidally then loculicidally dehiscent; seeds several. Fl. Jun–Jul, fr. Apr.

• Open fields at roadsides. Guangdong (Raoping).

**51. *Hedyotis scandens*** Roxburgh, Fl. Ind. 1: 369. 1820.

攀茎耳草 *pan jing er cao*

*Oldenlandia scandens* (Roxburgh) Kuntze.

Shrubs or herbs, perennial, lianescent, climbing, or scandent, to several meters; stems compressed terete to angled, smooth or sulcate, glabrous or puberulent in lines. Leaves sessile to petiolate; petiole to 5 mm, glabrous; blade drying papery to subleathery, pale abaxially, oblong-lanceolate, elliptic, narrowly elliptic, or elliptic-oblong, 5–10 × 1.5–4 cm, glabrous, base acute to cuneate then decurrent, apex long acuminate; secondary veins 3–5 pairs but not evident; stipules fused to petiole bases, truncate to triangular, 2.5–4 mm, glabrous to usually puberulent or strigillose, ciliolate to entire, apex acute to acuminate or bilobed, sometimes glandular and/or with bristle

inserted below top of stipule. Inflorescences terminal and usually also in axils of uppermost leaves, cymose to compound-cymose, 2–15 cm, densely pilosulous or hirtellous, pedunculate; peduncles 2–3 cm; bracts triangular to narrowly triangular, 0.3–6 mm; pedicels 1–3 mm. Flowers pedicellate, distylous. Calyx glabrous; hypanthium portion obconical, ca. 1 mm, sometimes ridged; limb 1–2 mm, lobed for 1/3–1/2, lobes triangular and thickened, sometimes costate. Corolla white or yellow, tubular-funnelform to funnelform, outside glabrous [or puberulent in India], inside densely villous in throat and throughout lobes; tube 1–2 mm; lobes narrowly spatulate-oblong to narrowly triangular, 3–4 mm, acute. Anthers shortly to long exerted, ca. 1.2 mm. Stigmas 0.3–1 mm. Fruit capsular, subglobose, ellipsoid, or ovoid, 3–5 × 3–5 mm, glabrous, cartilaginous to stiffly papery, loculicidally dehiscent across top then sometimes septicidal, beak rounded to conical, 1.2–2 mm; seeds several, black, angled. Fl. Jul–Sep, fr. Aug–Sep.

Sparse forests, on humid soil in valleys; 1000–1800 m [as low as ca. 700 m in India]. Yunnan [Bangladesh, Bhutan, India, Myanmar, Nepal, Vietnam].

**52. *Hedyotis shenzhenensis*** Tao Chen, Edinburgh J. Bot. 64: 331. 2007.

深圳耳草 *shen zhen er cao*

Herbs, perennial, erect, to 40 cm tall; stems glabrous. Leaves subsessile; blade drying subleathery, adaxially dark green, abaxially pale green, elliptic, elliptic-oblong, or obovate, 8.5–15 × 5–9 cm, glabrous, base cuneate to rounded or cordulate, apex acute to obtuse; secondary veins 4–6 pairs but rather indistinct; stipules fused to leaf bases or very shortly around stem, triangular, 3–5 mm, shortly pubescent, ciliolate, acute. Inflorescence terminal, paniculate, many flowered, branched to several orders, glabrous, flushed with purple; peduncle 10–18 cm; axes flattened to 4-angled; bracts narrowly triangular, 0.2–3 mm; pedicels to 2 mm. Flowers sessile and/or pedicellate, distylous. Calyx glabrous; hypanthium portion obconic, ca. 1 mm; limb deeply lobed; lobes narrowly triangular to ovate, ca. 1.5 mm. Corolla white, tubular-urceolate, glabrous outside; tube ca. 3 mm, villous from middle into throat; lobes ovate to elliptic-triangular, 1.8–2.5 mm. Anthers included or exerted, 0.6–0.8 mm. Stigma included or exerted, ca. 1 mm. Fruit capsular, subglobose, ca. 2 mm, glabrous, weakly ribbed, septicidally dehiscent; seeds numerous, black, irregularly angled. Fl. Apr–Jun, fr. May–Oct.

• Understories of broad-leaved forests; 400–700 m. Guangdong (Shenzhen).

This species was treated by Chen (in T. L. Wu, Check List Hong Kong Pl. 265–266. 2002) under the name *Hedyotis yangchunensis*. The flower sizes in the figure in the protologue, according to the scale in that figure, do not precisely agree with the measurements given in the protologue description.

**53. *Hedyotis strigulosa*** (Bartling ex Candolle) Fosberg, Smithsonian Contr. Bot. 45: 28. 1980.

肉叶耳草 *rou ye er cao*

*Oldenlandia strigulosa* Bartling ex Candolle, Prodr. 4: 427. 1830; *Hedyotis coreana* H. Léveillé; *H. taiwanensis* S. F.

Huang & J. Murata [“*taiwanense*”]; *Thecagonum strigulosum* (Bartling ex Candolle) Terrell & H. Robinson.

Herbs, annual or perennial, prostrate to erect, to 15(–20) cm tall; stems terete or weakly to sharply 4-angled, sometimes sulcate, glabrous. Leaves sessile; blade very fleshy, drying leathery, oblong-obovate, elliptic-oblong, oblanceolate, or spatulate, 1–2.5 × 0.2–1 cm, glabrous, base acute to decurrent, apex rounded, obtuse, or acute; secondary veins indistinct; stipules fused to petiole bases, triangular, 1–2 mm, glabrous, with 2 central longitudinal lines of glandular trichomes or fleshy ornamentation, acute to acuminate. Inflorescences terminal and sometimes in axils of uppermost leaves, 1-flowered or 2–12-flowered and shortly cymose, fasciculate, or paniculate, glabrous, subsessile to pedunculate; peduncles to 1.5 cm; bracts triangular, 0.1–2 mm; pedicels 1–12 mm. Flowers pedicellate. Calyx glabrous; hypanthium portion turbinate to ellipsoid, 1–1.5 mm; limb lobed for 1/2–2/3; lobes triangular to lanceolate, 0.8–2 mm. Corolla white, tubular, glabrous outside; tube 1.2–1.5 mm, barbate in throat; lobes triangular to oblanceolate, 1.2–2 mm. Anthers not seen. Stigmas ca. 0.8 mm, exerted. Fruit capsular, subglobose, hemispherical, or compressed turbinate, 3.5–5 mm, glabrous, loculicidal across top, sometimes with rudimentary beak; seeds numerous, blackish brown, subglobose to angled, foveolate. Fl. and fr. Dec–Apr.

Sandy or muddy beaches, wastelands, on rocks near sea; sea level to near sea level. Guangdong, Taiwan, Zhejiang [Japan, Korea; Micronesia].

*Hedyotis taiwanensis* was treated as a species separate from *H. coreana* by W. C. Ko (in FRPS 71(1): 39, 73. 1999), and the name *H. strigulosa* was not cited by her. However, *H. coreana* was synonymized under *H. strigulosa* by Fosberg (loc. cit.), though provisionally. *Hedyotis taiwanensis* was synonymized with *H. strigulosa* by Fl. Taiwan (ed. 2, 4: 268. 1998). The Fl. Taiwan separated *Hedyotis strigulosa* from *H. biflora* based on the stoutness of the pedicels and fleshiness of the leaves, but different characters are used here and most of the specimens included by them in *H. strigulosa* are here included in *H. biflora*.

The Fl. Taiwan and Fl. Japan (3a: 217. 1993) included the Chinese plants in *Hedyotis strigulosa* var. *parvifolia* (Hooker & Arnott) T. Yamazaki (J. Jap. Bot. 58: 284. 1983). This name was not mentioned by W. C. Ko (loc. cit.) and was synonymized with *H. strigulosa* by the Kew Rubiaceae checklist (Govaerts et al., World Checkl. Rubiaceae; <http://www.kew.org/wcsp/rubiaceae/>; accessed on May 2007), though without any source or explanation. The basionym of this name is *H. biflora* var. *parvifolia* Hooker & Arnott (Bot. Beechey Voy. 264. 1838). *Hedyotis biflora* var. *parvifolia* was reported from Zhejiang (Qiu & Zhong, Fl. Zhejiang 6: 121–122. 1986), but that report is here interpreted as *H. strigulosa*.

**54. *Hedyotis tenelliflora*** Blume, Bijdr. 971. 1826–1827.

纤花耳草 xian hua er cao

*Hedyotis angustifolia* Chamisso & Schlechtendal; *Oldenlandia angustifolia* (Chamisso & Schlechtendal) Benthams; *O. tenelliflora* (Blume) Kuntze; *Scleromitron angustifolium* (Chamisso & Schlechtendal) Benthams; *S. sinense* Miquel.

Herbs, annual or perennial, diffusely branched, to 40 cm tall, often drying blackened; stems subterete and smooth or weakly to sharply 4-angled and/or 2-sulcate, glabrous or often

scaberulous along grooves and/or near nodes. Leaves sessile or subsessile; petiole to 1 mm, glabrescent; blade drying thinly leathery, linear, linear-lanceolate, narrowly elliptic-oblong, or narrowly spatulate, 1.2–5 × 0.15–0.4 cm, adaxially glabrous or scaberulous near margins, abaxially glabrous, both surfaces sometimes apparently scaly due to collapsed large epidermal cells, base cuneate, acute, or decurrent, margins frequently revolute, apex acute or acuminate; secondary veins not visible; stipules fused to petiole bases, triangular to rounded, 1–2 mm, puberulent, hispidulous, or glabrescent, with 2–5 linear or setiform lobes 1–4 mm. Inflorescences axillary, 1-flowered or 2- or 3-flowered in each axil, congested-cymose, glomerulate, or fasciculate, 4–8 mm in diam., sessile to subsessile; bracts acicular to lanceolate, 1–2.5 mm, entire or marginally scaberulous; pedicels to 1 mm. Flowers sessile to subsessile, apparently homostylous. Calyx glabrous; hypanthium portion subglobose to obovoid, ca. 1 mm; limb lobed nearly to base; lobes linear-lanceolate, triangular, or spatulate, 1.5–2 mm, ciliolate. Corolla white, funnellform, outside glabrous; tube ca. 2 mm, pubescent in throat; lobes narrowly spatulate-oblong, 1–2 mm. Anthers exerted, ca. 1 mm. Stigma 0.2–0.3 mm. Fruit capsular, ovoid, 2–2.5 × 1.5–2 mm, cartilaginous to stiff, loculicidal across top; seeds numerous. Fl. and fr. Apr–Dec.

Slopes in valleys, ridges of fields; 100–1400 m. Fujian, Guangdong, Guangxi, Hainan, Sichuan, Taiwan, Yunnan, Zhejiang [India, Indonesia, Japan, Malaysia, Philippines, Thailand, Vietnam; Australia, Melanesia].

This species has been treated by most authors as *Hedyotis tenelliflora*; however, Dutta and Deb (Taxon. Rev. *Hedyotis*. 2004) considered that a distinct species and treated these plants as *H. angustifolia*. Unfortunately, they presented no discussion of this situation nor details of the actual identity and range of “true” *H. tenelliflora*; consequently, their conclusion is not yet accepted here.

W. C. Ko (in FRPS 71(1): 41. 1999) described the leaves as densely rotund transparent scaly, which apparently refers to the relatively large epidermal cells that are visible under magnification and sometimes apparently collapse. This character was noted in the Fl. Bhutan (2(2): 757–764. 1999) for several *Hedyotis* species.

The name *Scleromitron sinense* is here provisionally placed in synonymy with *Hedyotis tenelliflora*. As detailed by Sivaranjan and Nair (Taxon 35: 363–369. 1986), the name *Spermacoce stricta* Linnaeus f. has also been considered by some authors to apply to *H. tenelliflora* (in which case it would have priority), but the identity of that *Spermacoce* name is so unclear and controversial, as well as involving plants from our flora area, that it is better left aside for now. Other authors have suggested that *S. stricta* is actually a synonym of *H. verticillata*.

**55. *Hedyotis tenuipes*** Hemsley, J. Linn. Soc., Bot. 23: 375. 1888.

细梗耳草 xi geng er cao

*Oldenlandia tenuipes* (Hemsley) Kuntze.

Herbs or shrubs, erect, perennial, to 50 cm tall; stems terete to weakly 4-angled, often flexuous, puberulent to glabrous. Leaves subsessile to petiolate; petiole to 2(–6) mm; blade drying papery, usually clear green, narrowly lanceolate, lanceolate, ovate, or lanceolate-elliptic, 2.5–9 × 0.7–3 cm, both surfaces glabrous except densely puberulent on midrib adaxially,

base cuneate to rounded, apex acute to acuminate; secondary veins 3 or 4 pairs but usually indistinct; stipules fused to petiole bases, triangular, ovate, or subtruncate, 1–3 mm, densely puberulent, acute to acuminate, marginally entire, serrulate, or occasionally glandular-erose. Inflorescences terminal and often axillary and/or pseudoaxillary in uppermost leaf axils, cymose to paniculate, 4–18 cm, glabrous, several to many flowered, pedunculate; peduncle 0.5–2 cm; axes slender, flexuous, spreading at up to 90°; bracts linear to narrowly triangular, 1–5 mm; pedicels 4–15 mm. Flowers all pedicellate, apparently monomorphic. Calyx glabrous; hypanthium portion turbinate to ellipsoid, 1–1.5 mm; limb lobed for 2/3–3/4; lobes narrowly triangular to lanceolate, 1–1.5 mm. Corolla white, sometimes tinged pink to purple, funnellform, outside glabrous, inside densely barbate in throat and throughout lobes; tube 1.5–3 mm; lobes lanceolate to spatulate, 3–4 mm, acute to acuminate. Anthers partially to fully exerted, ca. 1.5 mm. Stigma 0.1–0.2 mm, exerted by 3–4 mm. Fruit capsular, ovoid to ellipsoid, 2–2.5 mm, glabrous, smooth, septicidally then loculicidally dehiscent; seeds numerous, black, angled. Fl. Jun–Aug, fr. Jun–Nov.

• Sandy lands, barren soil in sparse forests; 200–1000 m. Fujian, Guangdong, Hainan.

This species is similar to *Hedyotis matthewii* and *H. mellii* and is perhaps separated here somewhat differently from other authors (e.g., W. C. Ko in FRPS 71(1): 52. 1999). The pedicel measurements here are for flowers at anthesis and fruit; the pedicels subtending flower buds are much shorter and apparently elongate rapidly as the buds mature.

**56. *Hedyotis terminaliflora*** Merrill & Chun, Sunyatsenia 2: 326. 1935.

顶花耳草 ding hua er cao

Herbs or subshrubs, perennial, erect, to 100 cm tall; stems terete, flattened or weakly 4-angled, 2- or 4-sulcate, glabrescent or sparsely to densely strigillose to hirtellous throughout or in lines along grooves. Leaves petiolate; petiole 1–4 mm, densely puberulent, strigillose, or glabrescent; blade drying papery or subleathery, a bit fragile, ovate, oblong-ovate, lanceolate, or oblong-lanceolate, 2.2–8 × 1–3 cm, adaxially glabrous and shiny, abaxially sparsely to densely puberulent to strigillose, base obtuse to rounded, apex acute to shortly acuminate; secondary veins 2–4 pairs; stipules shortly fused to petiole bases, ovate, triangular, or narrowly triangular, 2–5 mm, glabrous to densely puberulent or strigillose, lacinate or glandular-setose. Inflorescence terminal, subcapitate, hemispherical to subglobose, 1.5–1.8 cm in diam., glabrescent, sessile or subsessile; bracts narrowly lanceolate to narrowly triangular, 1–5 mm; pedicels to 2 mm. Flowers sessile to pedicellate. Calyx glabrescent; hypanthium portion cylindrical, ca. 1 mm; limb deeply lobed; lobes narrowly spatulate-oblong, narrowly triangular, or narrowly elliptic, 3–4 mm, sometimes unequal, usually ciliate. Corolla funnellform, outside glabrous; tube ca. 3.5 mm, barbate in throat; lobes triangular, ca. 2.5 mm. Anthers exerted, ca. 1 mm. Stigmas not seen. Fruit capsular, subglobose to ellipsoid, ca. 2.5 mm in diam., glabrescent, cartilaginous, septicidally dehiscent then quickly loculicidal; seeds several, black, angled. Fl. Feb–Mar, fr. Aug–Nov.

• Broad-leaved forests on mountaintops; 600–1100 m. Hainan.

Broader morphological variation is included in this species here than in the original species circumscription, based on study of specimens. This is the first description of the corolla; it is based on *Liu Qinqu 25932* (MO).

**57. *Hedyotis tetragonalis*** (Korthals) Walpers, Ann. Bot. Syst. 2: 769. 1852.

方茎耳草 fang jing er cao

*Diplophragma tetragonale* Korthals, Ned. Kruidk. Arch. 2: 149. 1851 [“*tetragonalis*”]; *Hedyotis parryi* Hance; *H. quadrangularis* Miquel; *Oldenlandia parryi* (Hance) Kuntze; *O. quadrangularis* (Miquel) Kuntze.

Herbs or subshrubs, erect, perennial or perhaps sometimes annual, to 50 cm tall; stems subterete to 4-angled with angles thickened to ridged, glabrous. Leaves sessile; blade drying papery, linear, linear-lanceolate, narrowly elliptic, or narrowly elliptic-oblong, 1–3.5 × 0.2–0.55 cm, glabrous, base acute to obtuse and usually decurrent, margins usually revolute, apex acute; secondary veins not visible; stipules shortly fused to petiole bases, triangular to truncate, 1–1.5 mm, glabrous, rounded to acute or usually with leaflike appendage, this narrowly elliptic to lanceolate, 2–10 mm, entire or shortly 2- or 3-lobed or -setose. Inflorescences terminal and sometimes in axils of uppermost leaves, compound-cymose to paniculate, 4–13 cm, glabrous, many flowered, pedunculate; peduncle 1–5.5 cm; axes mostly regularly dichotomous; bracts linear, 1–2.5 mm; pedicels (or ultimate inflorescence axes) 0.5–3 mm. Flowers subsessile or pedicellate, apparently distylous. Calyx glabrous; hypanthium portion turbinate, 0.8–1 mm; limb lobed nearly to base; lobes narrowly lanceolate to narrowly triangular, 1–1.5 mm. Corolla white, tubular or tubular-funnelform, outside glabrous, inside tomentose at throat and onto lobes; tube ca. 2 mm; lobes lanceolate-oblong, ca. 2 mm. Anthers included or exerted, 0.8–1 mm. Stigmas 0.8–1 mm, included or exerted. Fruit capsular, subglobose, sometimes slightly didymous, ca. 2 × 2 mm, glabrous, septicidally then loculicidally dehiscent; seeds several, black, angled. Fl. and fr. Jul–Nov.

Open fields, grassy slopes, sometimes on ridges of farmlands; low elevations. Guangdong, Guangxi [Borneo, Cambodia, Indonesia, Malaysia, Thailand, Vietnam].

Merrill and Metcalf (Lingnan Sci. J. 16(3): 400. 1937) noted that Valetton provided a much-expanded and detailed description of this species (Bot. Jahrb. Syst. 44: 543. 1910), and they formally synonymized *Hedyotis parryi* with *H. tetragonalis*, though as “*tetragonalis*.”

**58. *Hedyotis trinervia*** (Retzius) Roemer & Schultes, Syst. Veg. 3: 197. 1818.

三脉耳草 san mai er cao

*Oldenlandia trinervia* Retzius, Observ. Bot. 4: 23. 1786; *Hedyotis rotundifolia* Sprengel, nom. illeg. superfl.

Herbs, annual, prostrate to weakly erect, to 15 cm tall; stems 4-angled to 4-winged, hirsute to pilose. Leaves subsessile to petiolate; petiole to 2 mm, pilose to hirsute; blade drying papery, ovate, elliptic, or suborbicular, 0.3–1.2 × 0.6–1 cm, adaxially glabrous, abaxially glabrous or sparsely strigillose to hispid, base obtuse and shortly decurrent, margins usually ciliate,

apex obtuse and shortly acuminate; secondary veins 2 or 3 pairs; stipules fused to petiole bases, hispidulous to villosulous, truncate, ca. 0.5 mm, irregularly erose and with 1–3 narrowly triangular to linear lobes or bristles 0.3–1 mm. Inflorescences axillary, 1-flowered to 2–4-flowered and cymose or fascicled, pilose, subsessile; pedicels to 1.5 mm. Flowers subsessile to pedicellate. Calyx pilosulous to hispidulous; hypanthium portion subglobose, ca. 1 mm; limb lobed nearly to base; lobes triangular, 1–1.2 mm. Corolla white, rotate, apparently glabrous; tube ca. 0.5 mm; lobes 1–2 mm. Anthers exerted or included, 0.5–1 mm. Stigmas included. Fruit capsular, subglobose, somewhat didymous, 1–2 × 1–1.5 mm, pilosulous or hispidulous, loculicidally dehiscent across top; seeds several, black, angled. Fl. and fr. Oct–Mar.

Sparse forests on mountains. Hainan (Ledong) [India, Indonesia, Malaysia, Sri Lanka, N Vietnam].

The descriptions seen suggest that this is a rather distinctive species. The description here is compiled from Dutta and Deb (Taxon. Rev. *Hedyotis*. 2004) and Augustine (J. Econ. Taxon. Bot. 26: 91. 2002).

The synonym *Hedyotis rotundifolia* was attributed by W. C. Ko (in FRPS 71(1): 76. 1999) to Candolle, but Candolle clearly indicated (Prodr. 4: 420. 1830) that Sprengel was the author of the name. W. C. Ko gave the range of this species as including “Tropical Africa,” but Verdcourt (Fl. Trop. E. Africa, Rub. (Pt. 1), 279–280. 1976) noted that throughout Africa this name was long incorrectly applied to *Oldenlandia gorenensis* (Candolle) Summerhayes (= *H. gorenensis* Candolle); thus, *H. trinervia* is not currently known from Africa.

**59. *Hedyotis uncinella*** Hooker & Arnott, Bot. Beechey Voy. 192. 1833.

长节耳草 chang jie er cao

*Hedyotis borrierioides* Champion ex Bentham; *H. kurarurensis* Hayata; *H. uncinella* var. *cephalophora* Craib; *Oldenlandia uncinella* (Hooker & Arnott) Kuntze.

Herbs, perennial, erect, to 70 cm tall; stems 4-angled and/or sulcate, angles becoming sharp and thickened or narrowly winged, sparsely to densely puberulent or hispidulous to glabrescent. Leaves opposite or rarely ternate at 1 or 2 nodes, subsessile to petiolate; petiole to 2.5 mm, puberulent to glabrescent; blade drying papery, ovate-oblong, oblong-lanceolate, ovate, lanceolate, or elliptic, 1.5–7.5 × 0.4–3.8 cm, both surfaces sparsely to densely puberulent, hispidulous, or pilosulous, base acute to rounded and usually shortly decurrent, apex acute to acuminate; secondary veins 4 or 5 pairs; stipules interpetiolar, triangular to narrowly triangular, 2–3.5 mm, moderately to densely pilosulous, pilosulous, or puberulent, acute, aristate, or usually lacinate or with 2–5 linear lobes or bristles 0.5–2 mm. Inflorescences terminal and axillary in axils of uppermost leaves, capitate or glomerulate, 8–15 mm in diam., globose, many flowered, sessile; bracts linear to lanceolate, 0.5–2 mm. Flowers sessile or subsessile, distylous. Calyx moderately to densely pilosulous to hispidulous; hypanthium portion subglobose to obconic, ca. 1 mm; limb lobed essentially to base; lobes narrowly triangular, 2.5–4 mm, ciliolate. Corolla white or purple, funnellform or tubular-funnelform, outside puberulent or pilosulous at least on lobes; tube 3–3.5 mm, tomentose in throat;

lobes oblong-lanceolate, 1.5–2 mm. Anthers exerted or included, 0.8–1 mm. Stigma 0.3–1 mm, included or exerted. Fruit capsular, subglobose to broadly ovoid, 1.5–2 × 1.8–2 mm, often somewhat compressed, septicidally dehiscent then loculicidal, with stipes or pedicels to 1 mm; seeds several, pale brown, angled. Fl. and fr. Apr–Sep.

Dry open fields; 200–1200 m. Fujian, Guangdong, Guizhou, Hainan, Hunan, Taiwan [India, Myanmar].

The name *Hedyotis uncinella* var. *cephalophora* has been cited as a combination by some authors, but the basionym cited for it, “*H. cephalophora* R. Brown,” is apparently a nomen nudum.

W. C. Ko (in FRPS 71(1): 60. 1999) described the anthers as ca. 3 mm, which has not been reported by any other authors nor seen on any specimens.

**60. *Hedyotis vachellii*** Hooker & Arnott, Bot. Beechey Voy. 194. 1837.

香港耳草 xiang gang er cao

*Oldenlandia vachellii* (Hooker & Arnott) Kuntze.

Herbs or subshrubs, erect, to 40 cm tall; stems terete, weakly angled, or flattened, glabrous. Leaves subsessile to petiolate; petiole to 8 mm, glabrous; blade drying papery to subleathery, oblong-lanceolate, elliptic, lanceolate, or elliptic-oblong, 4–8.5 × 1–3.5 cm, glabrous, base acute to usually cuneate or obtuse, apex acute; secondary veins indistinct; stipules perhaps interpetiolar or shortly fused around stem, triangular to ovate, 1.5–2 mm, marginally densely glandular-ciliolate, acute to obtuse. Inflorescences terminal, paniculate, cymose, multichotomous, 4–8 × 3.5–8 cm, many flowered, glabrous, purple, pedunculate; peduncles 2–4.5 cm; principal lateral axes 0.8–1.5 cm; bracts lanceolate to narrowly triangular, 0.5–3 mm; pedicels to 1.5 mm. Flowers subsessile to pedicellate, floral biology unknown. Calyx glabrous, somewhat succulent; hypanthium portion turbinate to ellipsoid, 0.9–1 mm; limb lobed essentially to base; lobes lanceolate to narrowly triangular, 1.2–2 mm. Corolla white to pale green, salverform, outside glabrous; tube 2.5–3 mm, sparsely pubescent inside; lobes ovate-triangular, ca. 2 mm. Anthers exerted, ca. 1.2 mm. Stigma included. Fruit capsular, subglobose, ca. 1.8 mm in diam., dehiscent; seeds several, brown. Fl. Apr–Aug.

• Hong Kong (New Territories).

**61. *Hedyotis verticillata*** (Linnaeus) Lamarck, Tabl. Encycl. 1: 271. 1792.

粗叶耳草 cu ye er cao

*Oldenlandia verticillata* Linnaeus, Mant. Pl. 1: 40. 1767; *Hedyotis hispida* Retzius; *O. hispida* (Retzius) Poir.

Herbs, annual or perennial, diffusely branched, often decumbent, to 30 cm tall; stems flattened, subterete, or 4-angled and/or usually 2-sulcate, sparsely to densely hirtellous, hispidulous, and/or scaberulous. Leaves sessile to petiolate; petiole to 2 mm, scaberulous or hispidulous to glabrescent; blade drying papery or thinly leathery, narrowly elliptic or linear-lanceolate, 2.5–6 × 0.3–1.3(–2) cm, adaxially glabrous or scaberulous at least near margins, abaxially glabrous to densely hirtellous or

hispidulous at least on midrib, base acute to obtuse, margins often revolute at least when dry, apex acute or acuminate; secondary veins not visible; stipules shortly fused to petiole bases, triangular to subtruncate, 1–3 mm, sparsely to densely hispidulous to hirtellous, with 5–9 linear lobes or bristles 1–8 mm. Inflorescences axillary, glomerulate to congested-cymose, 5–10 mm in diam., several flowered, moderately to densely hispidulous, sessile; bracts linear to lanceolate, 1–4 mm. Flowers sessile to subsessile, apparently homostylous (e.g., *Anon.* 788, MO). Calyx densely hispidulous; hypanthium portion obconical to subglobose, ca. 1 mm; limb lobed essentially to base; lobes lanceolate to triangular, 1–2 mm, ciliolate. Corolla white, funnellform, outside glabrous except lobes sometimes bearded at apex; tube ca. 2 mm, glabrous inside; lobes lanceolate, 1.8–2 mm. Anthers exerted, ca. 1 mm. Stigma ca. 0.3 mm. Fruit capsular, ovoid, 2–3 × 1.5–2 mm, loculicidal across top, with calyx lobes to 3 mm, with petioles to 1.5 mm; seeds numerous, pale brown, angled. Fl. and fr. Mar–Nov.

Tussocks or thickets on foothills, roadsides, sparse forests; 200–1600 m. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Taiwan, Zhejiang [Bangladesh, Bhutan, India, Indonesia, Japan (Ryukyu Islands), Malaysia, Myanmar, Nepal, Philippines, Singapore, Thailand, Vietnam].

As noted under *Hedyotis tenelliflora*, *Spermacoce stricta* may be a synonym of *H. verticillata*.

W. C. Ko (in FRPS 71(1): 42. 1999) described the leaves as up to 2 cm wide; this has not been reported by other authors nor seen on any specimens.

**62. *Hedyotis vestita*** R. Brown ex G. Don, Gen. Hist. 3: 526. 1834.

脉耳草 mai er cao

*Hedyotis capituliflora* Miquel; *H. costata* (Roxburgh) Kurz (1876), not R. Brown ex G. Don (1834); *Metabolos lineatus* Bartling ex Candolle; *Spermacoce costata* Roxburgh.

Herbs, annual or perennial, diffusely branched, weak to clambering or prostrate, to 60 cm tall; stems flattened, 4-angled, or subterete, sometimes sulcate, densely villous or hirsute with trichomes drying golden yellow. Leaves subsessile to petiolate; petiole 1–10 mm, densely hirtellous to villous; blade drying membranous to papery, lanceolate, elliptic-lanceolate, or elliptic, 2–8 × 0.5–3 cm, adaxially sparsely to densely strigose and/or strigillose to hirsute on lamina and moderately to densely pilosulous on principal veins, abaxially sparsely strigillose to glabrescent on lamina and densely strigose to hirsute on principal veins, base cuneate to obtuse and frequently decurrent, apex acute to usually acuminate; secondary veins 4–6 pairs; stipules fused to petiole bases, truncate to triangular, 2–4 mm, moderately to densely hirtellous, hirsute, or villous, with 3–5 linear or setose lobes 2–5 mm. Inflorescences axillary, congested-cymose, capitate, or fasciculate, 5–20 mm, densely hirtellous to hirsute, several to many flowered, pedunculate; peduncles 1–3 per leaf axil, 2–12 mm; bracts subulate, to 1 mm. Flowers sessile or subsessile, distylous. Calyx densely hirtellous to villosulous; hypanthium portion turbinate to obconic, ca. 0.5 mm; limb lobed nearly to base; lobes lanceolate to triangular, 0.3–1 mm. Corolla white or purple, tubular to funnellform, outside puberulent to pilosulous; tube 1.2–1.5 mm, pu-

bescent in throat; lobes narrowly elliptic to triangular, 0.8–1.2 mm. Anthers 0.5–1 mm, exerted. Stigma 0.3–0.6 mm, exerted. Fruit indehiscent, subglobose, 0.8–1.5 mm in diam., pilosulous; seeds 6–8, black, trigonous. Fl. and fr. Jul–Nov.

Forest margins in valleys, open fields, grassy slopes; 400–2000 m. Guangdong, Guangxi, Hainan, Yunnan [India, Indochina, Indonesia, Malaysia, Philippines, Thailand].

This species has been treated by many previous authors under the name *Hedyotis costata*; the basionym of that name, *Spermacoce costata* Roxburgh, is indeed the oldest name for this species, but that epithet was previously occupied for another species in *Hedyotis* when Kurz published his name and, thus, was blocked from transfer.

**63. *Hedyotis wangii*** R. J. Wang, Acta Phytotax. Sin. 41: 85. 2003.

启无耳草 qi wu er cao

Herbs, annual or perennial, to 6 cm tall; stems glabrous. Leaves petiolate; petiole 3–6 mm; blade drying papery, elliptic-oblong or ovate-elliptic, 3–5 × 1.5–2.3 cm, glabrous, base obtuse, apex acute; secondary veins ca. 5 pairs; stipules broadly rounded, ca. 0.5 mm, with 3 or 4 linear to narrowly triangular lobes or bristles ca. 2 mm. Inflorescence terminal, capitate or subcapitate, pedunculate; peduncle ca. 1.7 cm; head solitary, ovoid, ca. 0.5 cm, 4- or 5-flowered; bracts linear-lanceolate, ca. 3 mm. Flowers sessile. Calyx sparsely hirtellous or pilosulous or perhaps glabrous; hypanthium portion ellipsoid to obconic, 0.8–1 mm, ribbed; limb lobed nearly to base; lobes lanceolate, narrowly triangular, or linear, ca. 2 mm. Corolla white, tubular-funnelform, inside villosulous in upper part of tube and onto lobes; tube ca. 7 mm; lobes lanceolate, ca. 1 mm. Anthers ca. 2 mm, apparently exerted. Stigmas ca. 0.8 mm, apparently exerted. Fruit capsular, subglobose, ca. 3 mm in diam., pilosulous to perhaps glabrescent; seeds numerous, angled, reticulate. Fl. and fr. Sep.

- Mixed forests; ca. 1400 m. S Yunnan (Jinghong).

The calyx (including presumably the hypanthium) was described in the protologue as pubescent but both this and the fruit are shown in the protologue figure as glabrous.

**64. *Hedyotis wuzhishanensis*** R. J. Wang, Novon 18: 266. 2008.

五指山耳草 wu zhi shan er cao

Subshrubs or shrubs, erect, perennial, to 1 m tall; stems terete, densely villous to hirtellous. Leaves petiolate; petiole 3–10 mm, densely hirtellous; blade drying papery, elliptic, ovate, or lanceolate, 2.5–6.2 × 1.4–3.3 cm, adaxially sparsely to moderately strigose to hispidulous, abaxially densely to moderately villosulous to hispidulous, base cuneate, obtuse, or rounded, apex acute; secondary veins 4 or 5 pairs, prominulous abaxially; stipules persistent or perhaps tardily deciduous, interpetiolar, triangular, 1–2.5 mm, densely hirtellous, acute to aristate. Inflorescences terminal, pseudoaxillary, and/or axillary in uppermost leaf axils, subcapitate, 0.7–1.2 cm in diam., densely hirtellous, (2–)6–15-flowered, subsessile, enclosed by lanceolate bracts 5–10 mm. Flowers sessile to subsessile, biology unknown. Calyx densely hirtellous; hypanthium portion ellipsoid, ca. 1.8 mm; limb lobed essentially to base; lobes narrowly trian-

gular, 1.5–3 mm. Corolla white, tubular-funnelform, outside glabrescent; tube 5.5–6.5 mm, inside villosulous in upper part and throat; lobes narrowly triangular to lanceolate, ca. 2.5 mm. Anthers exserted, 1.5–2 mm. Stigmas included, 1–2 mm. Fruit capsular, ovoid, ca. 3 × 2.5 mm, densely pilosulous or hirtellous, loculicidally dehiscent then septicial; seeds ca. 15, black, angled, ca. 0.5 mm. Fl. and fr. Oct–Dec.

- Forests; 600–1600 m. Hainan.

**65. *Hedyotis xanthochroa*** Hance, J. Bot. 23: 324. 1885.

黄叶耳草 huang ye er cao

*Oldenlandia xanthochroa* (Hance) Kuntze.

Herbs, perennial, erect, to 40 cm tall; stems obtusely 4-angled, shallowly sulcate, sparsely tomentulose, hispid, or pilosulous becoming glabrescent. Leaves sessile; blade drying stiffly papery, elliptic-oblong to ovate, 4–5.5 × 0.6–2.6 cm, adaxially sparsely to moderately scabrous to hispid on lamina and densely hispidulous to scaberulous on principal veins, abaxially hirtellous or hispidulous throughout with pubescence denser on veins, black glandular-punctate under magnification on both surfaces, base broadly rounded and somewhat amplexicaul, apex shortly acuminate; secondary veins ca. 4 pairs; stipules fused to petiole bases, triangular-lanceolate, 4–5 mm, hispidulous on margins or throughout, marginally lacinate to setose-lobed, apex acute to acuminate. Inflorescences terminal, congested-cymose to subcapitate, 1.5–4.5 cm, sparsely to densely hispid to pilosulous, several flowered, shortly pedunculate; peduncles 0.5–1.5 cm; bracts lanceolate, ovate, or narrowly elliptic, 4–8 mm; pedicels 1–4 mm. Flowers subsessile. Calyx sparsely villous; limb lobed; lobes linear-lanceolate, ca. 6 mm. Corolla dark purple, tubular, outside villous; tube ca. 5.5 mm; lobes ca. 5.5 mm. Anthers exserted. Stigma exserted. Fruit capsular, ellipsoid-oblong to obovoid, 3.5–4.5 mm, cartilaginous to papery, densely hispid to pilosulous, loculicidally and septicially dehiscent through apical portion then sometimes splitting septicially throughout, beak conical, ca. 1 mm, with persistent calyx lobes narrowly triangular, 5–5.5 mm, with partially persistent septal structure spongy-cartilaginous, ellipsoid, 3–3.5 mm, deeply pitted where seeds were situated; seeds several, black, triangular to irregularly angled, ca. 1 mm. Fl. Jul–Aug, fr. Dec.

- Mountain slopes in valleys at middle elevations. Guangdong.

**66. *Hedyotis yangchunensis*** W. C. Ko & Zhang, J. S. China Agric. Univ. 16(4): 45. 1995.

阳春耳草 yang chun er cao

Herbs or subshrubs, erect, to 50 cm tall; stems 4-angled to subterete, densely scabrous to smooth. Leaves petiolate, often crowded at tops of stems; petiole 15–20 mm, glabrous; blade drying thickly papery, narrowly elliptic, oblanceolate, or elliptic-oblong, (3–)8–12 × (1–)3–4.5 cm, glabrous, base acute and decurrent, apex obtuse to broadly obtuse; secondary veins 5–7 pairs; stipules broadly triangular, ca. 16 mm, lacerate or with several narrow lobes. Inflorescences and flowers not seen. Infructescences terminal, in a panicle of congested-cymose or capitate heads; heads 2–5, hemispherical to subglobose, 2–2.3 cm in diam., several flowered, pedunculate, enclosed by a pair of ovate reduced leaves or leaflike bracts ca. 15 mm; peduncles 5–7 cm; floral bracts linear, 5–7 mm; pedicels 2–3 mm. Fruit capsular, ellipsoid or subglobose, ca. 3 × 2–2.5 mm, membranous, septicially dehiscent then loculicidal, with calyx lobes lanceolate to elliptic, 3–3.5 mm, longitudinally veined, long acuminate; seeds several, black, angled. Fl. Apr–Jun.

- Hills, sparse forests in valleys; ca. 400 m. Guangdong (Yangchun).

**67. *Hedyotis yazhouensis*** F. W. Xing & R. J. Wang, Acta Phytotax. Sin. 41: 87. 2003.

崖州耳草 ya zhou er cao

Herbs or subshrubs, perennial, erect, to 10 cm tall; stems weakly 4-angled. Leaves sessile or subsessile, crowded at tops of stems; blade drying papery, obovate or ovate-elliptic, 8–20 × 4–12 cm, base obtuse, apex obtuse to broadly obtuse; secondary veins 5–8 pairs; stipules obtuse to spatulate, 2–6 mm, lacerate with lobes ca. 1 mm. Inflorescence terminal, capitate, hemispherical, 3–5 cm in diam., several flowered, sessile to subsessile; bracts linear-lanceolate, ca. 8 mm, acute. Flowers sessile. Calyx densely puberulent; hypanthium portion ellipsoid to obovoid, 3–4 mm; limb divided essentially to base; lobes linear, ca. 35 × 1 mm. Corolla blue-purple, slenderly funnel-form, outside sparsely puberulent; tube ca. 30 mm; lobes ovate, ca. 1 mm. Stigmas included. Fruit indehiscent, ellipsoid to obovoid, ca. 3 mm, densely pilosulous; seeds 8–12, black, papillose. Fl. and fr. Oct.

- Understories of tropical rain forests; 100–300 m. S Hainan (Sanya).

**36. HIMALRANDIA** T. Yamazaki, J. Jap. Bot. 45: 340. 1970.

须弥茜树属 xu mi qian shu shu

Chen Tao (陈涛); Charlotte M. Taylor

Shrubs, sometimes late deciduous, often with short shoots, unarmed [sometimes with spinescent short shoots]. Raphides absent. Leaves opposite, often crowded at apices of short shoots, sometimes with domatia; stipules persistent, interpetiolar, triangular. Inflorescences terminal usually on short shoots, 1-flowered, sessile or subsessile, enclosed by stipules or perhaps stipuliform bracts. Flowers bisexual, monomorphic. Calyx limb 5-lobed. Corolla pale green to pale yellow, salverform, hirsute inside tube; lobes 5, convolute in bud. Stamens 5, inserted in corolla throat, partially to fully exserted; filaments short or reduced; anthers apparently dorsifixed. Ovary 2-celled, ovules 2 or 3 in each cell on axile placentas; stigma fusiform, 2-lobed or 2-grooved, exserted. Fruit baccate, indehiscent, globose, apparently fleshy, color unknown, with calyx limb persistent; seeds 1–4, ellipsoid, medium-sized.

About three species: Afghanistan, Bhutan, China, India, Nepal, Pakistan; one species (endemic) in China.

**1. *Himalrandia lichiangensis*** (W. W. Smith) Tirvengadam, *Nordic J. Bot.* 3: 462. 1983.

须弥茜树 *xu mi qian shu*

*Randia lichiangensis* W. W. Smith, *Notes Roy. Bot. Gard. Edinburgh* 8: 200. 1914.

Shrubs, 0.6–3 m tall, many branched; branches stout, weakly flattened to terete, rigid, pilosulous or strigillose to glabrescent. Leaves sessile or subsessile with petiole to 1 mm; blade drying papery to thinly leathery and often black, obovate or obovate-spatulate, 1–6.5 × 0.6–3.5 cm, both surfaces moderately to densely strigillose, base cuneate to obtuse, apex acute to obtuse; secondary veins 3–5 pairs, sometimes with pilosulous

domatia in abaxial axils; stipules ovate to triangular, 2.5–5 mm, densely pilosulous, acute to acuminate, often spreading to reflexed. Calyx pilosulous; hypanthium portion ellipsoid, ca. 2 mm; limb ca. 3 mm, deeply lobed; lobes triangular, ciliate, acute. Corolla yellow; tube ca. 3 mm; lobes triangular to ovate, ca. 5 mm, acute. Berry 5–6 mm in diam.; seeds 1 or 2, ca. 3 mm in diam. Fl. May, fr. Jul–Nov.

• Forests or thickets at streamsides in valleys or on mountains; 1400–2400 m. Sichuan, N Yunnan.

The stamens are described as either partially exerted, according to the description of W. C. Chen (in *FRPS* 71(1): 360. 1999), or fully exerted, according to the accompanying figure (p. 359, t. 94).

### 37. HYMENODICTYON Wallich in Roxburgh, *Fl. Ind.* 2: 148. 1824, nom. cons.

土连翘属 *tu lian qiao shu*

Chen Tao (陈涛); Charlotte M. Taylor

Shrubs or trees [or sometimes epiphytic or lianescent], usually deciduous, unarmed; bark notably bitter. Raphides absent. Leaves opposite, usually with domatia; margins rarely irregularly lobed and/or serrate; stipules deciduous, interpetiolar, triangular to ligulate, entire or glandular-serrate, usually strongly reflexed. Inflorescence terminal and/or axillary, spiciform to racemiform or sometimes paniculate with axes racemiform or spiciform, many flowered, erect to pendulous, pedunculate, bracteate with 1–4 leaf-like to petaloid, stipitate, veined basal bracts and other bracts usually reduced [or sometimes well developed]. Flowers sessile to shortly pedicellate, bisexual, monomorphic. Calyx limb deeply 5(or 6)-lobed. Corolla white, green, yellow, or red, funnelliform or narrowly campanulate, inside glabrous; lobes 5, valvate in bud, apparently often ascending or remaining partially closed at anthesis. Stamens 5, inserted in corolla tube below throat, included; filaments short, flattened; anthers basifixed, sagittate at base. Ovary 2-celled, ovules several to numerous in each cell on axile placentas; stigma fusiform or capitate, well exerted. Infructescences with pedicels and sometimes peduncles often elongating and/or becoming reflexed. Fruit capsular, ellipsoid-oblong to obovoid or ellipsoid, loculicidally dehiscent into 2 valves, woody to cartilaginous, with calyx limb deciduous; seeds numerous, medium-sized, flattened, with broad, membranous, shortly erose, basally 2-lobed wing; endosperm fleshy; embryo small; cotyledon oblong or orbicular.

Twenty-two species: Africa, tropical Asia, and Madagascar; two species in China.

The flowers apparently all open nearly simultaneously on a plant, probably within a very few days at most. The corolla lobes appear to remain partly closed when the flower is mature and the stigma well exerted; Razafimandimbison and Bremer (*Bot. J. Linn. Soc.* 152: 335. 2006) reported that the flowers are protandrous, so this may be a secondary position after the anthers have released their pollen and while the stigma is receptive. Occasional irregularly lobed leaves, similar to those of plants of *Hymenodictyon*, are found in a few other Rubiaceae genera (e.g., *Simira* Aublet of the Neotropics).

W. C. Chen (in *FRPS* 71(1): 227. 1999) described the corolla lobes as imbricate in bud and the anthers as dorsifixed, but Bridson and Verdcourt (*Fl. Trop. E. Africa, Rub.* (Pt. 2), 452. 1988) and Razafimandimbison and Bremer (loc. cit.) described them as valvate and basifixed, respectively, which corresponds to observations of Chinese specimens (*Henry 12150*, MO!).

- 1a. Inflorescences axillary, at each leaf axil simple, with 1 racemiform or spiciform axis; leaf blade glabrous to glabrescent on both surfaces or sometimes pilosulous abaxially ..... 1. *H. flaccidum*  
 1b. Inflorescences axillary and sometimes also terminal, simple or at least part branched and paniculate with several spiciform to racemiform axes; leaf blade pilosulous on both surfaces ..... 2. *H. orixense*

**1. *Hymenodictyon flaccidum*** Wallich in Roxburgh, *Fl. Ind.* 2: 152. 1824.

土连翘 *tu lian qiao*

Trees, deciduous, 6–20 m tall; bark gray, smooth; branches rather stout, weakly flattened to terete, glabrous to puberulent. Leaves often crowded at ends of branches; petiole 2.5–9 cm, puberulent or pilosulous to glabrescent; blade drying papery or thinly leathery, ovate, obovate, elliptic, or elliptic-oblong, 10–26 × 7–15 cm, glabrous to glabrescent on both surfaces or sometimes pilosulous abaxially, base acute to obtuse, margins entire or rarely serrate or lobed in distal part, apex acute to acu-

minate or rarely rounded; secondary veins 7–11 pairs, usually with pilosulous domatia; stipules ovate-oblong or triangular, 5–20 mm, densely pilosulous to glabrescent, acute to obtuse or bilobed for up to 1/2. Inflorescences axillary, simple, densely racemiform to spiciform, 10–30 cm, pilosulous to hirtellous, often pendulous; peduncle 3–5 cm; basal bracts 1 or 2, with blade leathery, ovate to elliptic-oblong or narrowly elliptic, 4–8.5 × 2–3 cm, pilosulous to glabrescent, on stipes 3–5.5 cm; pedicels 0.5–2 mm. Calyx densely puberulent; ovary portion ellipsoid, 1.2–1.5 mm; limb lobed essentially to base; lobes triangular to elliptic, 1–1.5 mm, ciliate, acute. Corolla yellow to red, densely puberulent to glabrescent outside; tube ca. 2

mm, slender and cylindrical in basal portion then abruptly inflated just below lobes; lobes ligulate to lanceolate or ovate, 2–3.5 mm, obtuse to acute. Style exerted for 2–5 mm. Fruiting pedicels to 8 mm, reflexed. Capsules dark brown, 1.2–1.5 × 0.5–0.8 cm, woody, with several prominent whitened, ellipsoid lenticels; seeds (including wing) ca. 10 × 5 mm. Fl. May–Jul, fr. Aug–Dec.

Forests or thickets at streamsides or in valleys; 300–3000 m. Guangxi, Sichuan, Yunnan [Bhutan, N India, Nepal, N Vietnam].

The name "*Hymenodictyon yunnanense*" was written by Pitard on a specimen of this species from Yunnan, China (*Ducloux 6767*, P!) but never validly published (Razafimandimbison & Bremer, Bot. J. Linn. Soc. 152: 370. 2006).

**2. *Hymenodictyon orixense*** (Roxburgh) Mabberley, Taxon 31: 66. 1982.

毛土连翘 mao tu lian qiao

*Cinchona orixensis* Roxburgh, Bot. Descr. Swietenia, 21. 1793; *C. excelsa* Roxburgh; *Hymenodictyon excelsum* (Roxburgh) Wallich.

Trees, deciduous, to 25 m tall; bark smooth, gray; branches rather stout, weakly flattened to terete, puberulent to densely pilosulous or glabrescent. Leaves often grouped near ends of branches; petiole 2–17 cm, pilosulous; blade drying papery or membranous, ovate-elliptic, elliptic, or broadly elliptic, 9–22 × 6–14 cm, both surfaces pilosulous with pubescence sometimes denser abaxially, base acute to obtuse, margins en-

tire, apex shortly acuminate or acute; secondary veins 7–10 pairs, sometimes with pilosulous domatia; stipules ovate to triangular or lanceolate, 5–20 mm, densely pilosulous, obtuse to acute or bilobed for up to 1/2. Inflorescences terminal and in axils of uppermost leaves, 15–20 cm, simple or branched at least in part, with axes densely spiciform to racemiform, pilosulous, usually pendulous; peduncles ca. 6 cm; basal bracts 2–4, with blade papery to leathery, ovate to elliptic or elliptic-oblong, 9–17 × 2–5.5 cm, pilosulous, with stipe 3–8 cm. Flowers subsessile or with pedicels to 2 mm. Calyx densely puberulent to pilosulous; ovary portion subglobose to ellipsoid, 1–1.5 mm; limb lobed essentially to base; lobes triangular to elliptic, 1–1.5 mm. Corolla white or brown, outside densely puberulent to pilosulous; tube 2.5–3.5 mm, slenderly cylindrical then abruptly inflated at lobes; lobes ligulate to lanceolate, 2–2.5 mm, acute. Style exerted for 2–5 mm. Fruiting pedicels to 10 mm, reflexed. Capsules brown, 1.2–3 × 0.5–1.1 cm, woody, with prominent whitened, elliptic lenticels; seeds (including wing) 7–8 mm. Fl. May–Jul, fr. May–Dec.

Thickets or forests at riversides, at field edges, and in valleys; 100–1700 m. Sichuan, Yunnan [Cambodia, India, Indonesia (Java), Kashmir, Laos, Malaysia, Myanmar, Nepal, Philippines, Thailand, Vietnam].

Mabberley (loc. cit.) noted that Roxburgh studied this species in India as one of several plants (in several families) for which the bitter bark was used medicinally. In India this species is used for good quality wood for furniture and small items, and its bark as a febrifuge and a source of dye (color not noted; Razafimandimbison & Bremer, Bot. J. Linn. Soc. 152: 375–377. 2006).

### 38. **HYPTIANTHERA** Wight & Arnott, Prodr. Fl. Ind. Orient. 1: 399. 1834.

藏药木属 zang yao mu shu

Chen Tao (陈涛); Charlotte M. Taylor

Shrubs or small trees, unarmed. Raphides absent. Leaves opposite, decussate, apparently without domatia; stipules persistent, interpetiolar, generally triangular with apices often twisted together at 180° in bud. Inflorescences axillary, glomerulate, several flowered, sessile, bracteate. Flowers sessile, apparently bisexual or reportedly at least sometimes unisexual, fragrant. Calyx limb 4- or 5-lobed. Corolla white, shortly funnellform to subrotate, inside pubescent in throat; lobes 4 or 5, convolute in bud. Stamens 4 or 5, inserted in corolla tube, included or partially exerted; filaments short or reduced; anthers dorsifixed, pubescent on base and outer surface, with connective apically prolonged and widened. Ovary 2-celled, ovules 6–10 in each cell on axile placentas; stigma 2-lobed with lobes oblong and pubescent, exerted. Fruit baccate, fleshy, ovoid or subglobose, at least sometimes black, with calyx limb persistent; seeds several, medium-sized, flattened, angular, with testa thickly fibrous striate, with hilum terminal and rather broad; endosperm fleshy; embryo small; cotyledons ovate, flat; radicle terete.

One or a few species: China, Bangladesh, Bhutan, India, Laos, Myanmar, Nepal, Thailand, Vietnam; one species in China.

Robbrecht and Puff (Bot. Jahrb. Syst. 108: 126–127, table 8. 1986) described the flowers as unisexual, but the corresponding condition of the plants (e.g., dioecious, polygamo-dioecious) is not noted and the specimens and figures seen seem to have bisexual flowers. W. C. Chen (in FRPS 71(1): 386. 1999) did not mention unisexual flowers for this species, and the accompanying figure apparently shows bisexual flowers (p. 387, t. 102). He described the stipules as caducous, but this has not been seen on any specimens of *Hyptianthera* nor reported by other authors, and it contradicts the figure. He also described the ovules as pendulous from the top of the cell, but Robbrecht and Puff (loc. cit.: 86–91), in a detailed morphological survey focused on gynoecium characters, described them as borne on axile placentas.

**1. *Hyptianthera stricta*** (Roxburgh) Wight & Arnott, Prodr. Fl. Ind. Orient. 1: 399. 1834.

藏药木 zang yao mu

*Randia stricta* Roxburgh, Fl. Ind. 2: 145. 1824.

Shrubs or small trees, 2–8 m tall; branches flattened be-

coming angled to subterete, glabrous. Petiole 0.4–1 cm, glabrous; leaf blade drying papery or thinly leathery and usually reddish brown, oblong-lanceolate, elliptic-oblong, or lanceolate, 5–15 × 1–5 cm, adaxially glabrous and slightly shiny, abaxially glabrous or sometimes hirtellous or pilosulous along principal veins, base cuneate to acute, apex acuminate to long acuminate; secondary veins 5–9 pairs; stipules triangular to ovate, 5–8 mm,

glabrous, abaxially smooth to weakly keeled, acuminate to shortly aristate. Inflorescences 6–10 mm in diam.; bracts triangular to ovate, 1–2.5 mm, adaxially white strigose, abaxially glabrescent, marginally ciliate, acute to acuminate. Calyx with ovary portion ellipsoid, ca. 0.5 mm, glabrescent; limb outside (i.e., abaxially) strigillose to glabrescent, inside (i.e., adaxially) densely strigillose, deeply lobed, with basal tubular portion 0.5–1 mm; lobes 5, lanceolate to narrowly triangular, 1.75–2 mm,

ciliate, shortly acuminate. Corolla abaxially glabrous; tube 1–2 mm; lobes 5, spatulate to subelliptic, 1–2 mm, adaxially white strigose, obtuse or infrequently emarginate. Stigma lobes 1–2 mm. Berry yellowish green, 8–9 × 5–6 mm, puberulent to glabrous; seeds usually 8, ca. 5 × 3 mm. Fl. Apr–Aug, fr. Aug–Feb.

Forests or thickets at streamsides or on mountains; 100–1500 m. Xizang (Médog), Yunnan [Bangladesh, Bhutan, India, Laos, Myanmar, Nepal, Thailand, Vietnam].

### 39. IXORA Linnaeus, Sp. Pl. 1: 110. 1753.

龙船花属 long chuan hua shu

Chen Tao (陈涛); Charlotte M. Taylor

*Schetti* Adanson; *Tsiangia* But, H. H. Hsue & P. T. Li.

Shrubs or small trees or occasionally perhaps climbing (*Ixora hekouensis*), unarmed. Raphides absent. Leaves opposite or rarely ternate, decussate, without domatia; petioles articulate at base; stipules persistent to caducous, interpetiolar or shortly united around stem, triangular, acute to usually aristate. Inflorescences terminal on principal stems [or sometimes terminal on reduced lateral stems and appearing axillary], cymose to corymbiform or paniculiform, few to many flowered, sessile to pedunculate, bracteate or bracts reduced; axes often articulate; bracteoles when present often fused in pairs. Flowers pedicellate or sessile, bisexual, monomorphic, often fragrant. Calyx limb truncate or 4-lobed. Corolla yellow, orange, red, or white, sometimes becoming reddened when dry, salverform with tube slender, inside glabrous or pubescent at throat; lobes 4 [rarely to 9], convolute in bud. Stamens 4, inserted at corolla throat, partially to fully exerted; filaments short or reduced; anthers dorsifixed near base. Ovary 2-celled, ovules 1 in each cell, pendulous from axile placentas attached in upper part of septum; style in upper portion fusiform or clavate; stigmas 2, linear, recurved, exerted. Fruit black or red, drupaceous, leathery or fleshy, subglobose to ellipsoid or ovoid, with calyx limb persistent; pyrenes 2, 1-celled, each with 1 seed, plano-convex or concavo-concave, smooth dorsally (i.e., abaxially), leathery, papery, or crustaceous; seeds medium-sized, ellipsoid to oblanceolate, grooved and concave ventrally (i.e., adaxially); testa membranous; endosperm cartilaginous; radicle terete, hypogeous.

About 300–400 species: widespread in tropical Africa, America, Asia, Madagascar, and Pacific islands; 18 species (nine endemic) in China.

*Ixora* has been studied in SE Asia only by Bremekamp; he published several articles treating the species of several regions there (cited by De Block, Opera Bot. Belg. 9: 213. 1998) but not specifically treating the Chinese species, although his circumscription of the region “Burma and the Andaman Islands” included some species from Xizang (Bremekamp, J. Bot. (London) 75: 108–111, 169–175, 260–266, 295–298, 318–326. 1937).

Several species of *Ixora* are widely cultivated in tropical regions as ornamentals, notably *I. casei* Hance, *I. coccinea* Linnaeus, *I. finlaysoniana*, and sometimes *I. chinensis*. In cultivation several of these have various forms with a wide range of flower color, flower and leaf size, and plant height, and sometimes they do not set fruit. *Ixora coccinea* and *I. casei* are not treated in this current flora but are included in the key to species below for identification. Reynolds and Forster (Austrobaileya 7(2): 253–278. 2006) reported that *I. coccinea* is locally adventive in some parts of Australia, which may be a possibility in China. The most commonly cultivated *Ixora* species were discussed in detail by Fosberg and Sachet (Baileya 23(2): 74–85. 1989).

*Ixora foonchewii* was described and illustrated as having consistently 5 corolla lobes and a stout, shortly bilobed stigma, so it does not seem to belong to *Ixora*; it is provisionally included here in *Tarenna*.

1a. Calyx lobes 3–6 mm.

2a. Leaves relatively narrow, 1–4 cm wide, acute to acuminate at both ends, with secondary veins

12–15 pairs; corolla tube 30–40 mm, lobes 6–7 mm ..... 18. *I. yunnanensis*

2b. Leaves not notably narrow, 3–9 cm wide, rounded to cuneate at base, obtuse, acute, or acuminate at apex, with secondary veins 9–12 pairs; corolla tube 20–30 mm, lobes 5–6 mm.

3a. Corolla lobes obtuse to rounded ..... 2. *I. cephalophora*

3b. Corolla lobes acute to subacute ..... 5. *I. finlaysoniana*

1b. Calyx lobes 0.1–1.5 mm.

4a. Leaves with secondary veins 5 or 6 pairs.

5a. Petioles 0–2 mm; corolla lobes 8–15 mm; flowers variously yellow to red; plants

cultivated ..... *I. coccinea* (see comment above)

5b. Petioles 2–8 mm; corolla lobes 6–7 mm; flowers white; plants native ..... 7. *I. hainanensis*

4b. Leaves with secondary veins 7–16 pairs.

6a. Petioles 10–20 mm, at least some of them more than 10 mm.

7a. Leaves shallowly bullate with principal veins impressed on puffy upper surface; corolla white to pink.

8a. Corolla tube 30–40 mm, lobes 5–7 mm ..... 12. *I. nienkui*

8b. Corolla tube 15–18 mm, lobes ca. 5 mm ..... 17. *I. tsangii*

- 7b. Leaves plane, with principal veins flat to prominent on flat upper surface; corolla red, purple, yellow-orange, pink, or white.
- 9a. Corolla red, tube ca. 10 mm, lobes ca. 5 mm ..... 13. *I. paraopaca*
- 9b. Corolla white, pink, yellow-orange, or red, tube 25–40 mm, lobes 5–15 mm.
- 10a. Stems relatively stout, youngest sections 3–5 mm in diam.; plants cultivated ..... *I. casei* (see comment above)
- 10b. Stems slender, youngest sections 1–3 mm in diam.; plants native.
- 11a. Corollas yellow-orange to red, with lobes 10–12 mm; stipule body (i.e., triangular portion) 2–3 mm ..... 6. *I. fulgens*
- 11b. Corollas white to pink, with lobes 5–7 mm; stipule body 3–10 mm ..... 12. *I. nienkui*
- 6b. Petioles 0–10 mm, at least some of them shorter than 10 mm.
- 12a. Leaves sessile or subsessile with petioles up to 4 mm, base cordate, cordulate, truncate, cuneate, rounded, or obtuse.
- 13a. Corollas red-purple, tube 8–9 mm, lobes 4–5 mm ..... 11. *I. longshanensis*
- 13b. Corollas white, red, or purple, tube 13–45 mm, lobes 5–7.2 mm.
- 14a. Corolla lobes broadly obtuse to rounded ..... 3. *I. chinensis*
- 14b. Corolla lobes acute to obtuse.
- 15a. Leaves 10–23 × 5.5–9 cm ..... 1. *I. auricularis*
- 15b. Leaves 4.5–12 × 2–7 cm.
- 16a. Corolla lobes obtuse ..... 14. *I. philippinensis*
- 16b. Corolla lobes acute ..... 15. *I. subsessilis*
- 12b. Leaves with petioles 2–10 mm, base rounded, cordulate, cuneate, obtuse, truncate, or acute.
- 17a. Peduncle ca. 14 cm ..... 10. *I. insignis*
- 17b. Peduncle 0.4–5 cm.
- 18a. Inflorescences with tertiary and often also quaternary axes well developed and spreading at 45°–90° or more; corolla tube 7–11 mm ..... 4. *I. effusa*
- 18b. Inflorescences with tertiary and quaternary axes developed to reduced and ascending at less than 45°; corolla tube 18–40 mm.
- 19a. Corolla lobes ovate, elliptic, or broadly elliptic, at apex broadly obtuse to rounded ..... 3. *I. chinensis*
- 19b. Corolla lobes elliptic-oblong, narrowly elliptic-oblong, ovate-lanceolate, narrowly spatulate, narrowly lanceolate, or oblong-lanceolate, at apex obtuse to acute.
- 20a. Calyx puberulent or glabrescent; corolla tube 18–20 mm, lobes 5–7 mm.
- 21a. Leaves 10–18 cm, at base cuneate to obtuse, at apex acuminate to acute; bracts 3.5–5 mm ..... 8. *I. hekouensis*
- 21b. Leaves 4.5–10 cm, at base truncate, rounded, or cordulate, at apex obtuse or rounded and apiculate; bracts 1.5–2 mm ..... 14. *I. philippinensis*
- 20b. Calyx glabrous; corolla tube 20–40 mm, lobes 5–7 mm.
- 22a. Leaves 15–17 × 6.5–7.5 cm; stipules villous adaxially ..... 16. *I. tibetana*
- 22b. Leaves 4–15 × 1–5 cm; stipules glabrescent adaxially.
- 23a. Low to medium-sized plants, flowering at 0.2–3 m tall; leaves rounded, obtuse, or bluntly acute at apex; corollas with tube 30–40 mm, in bud acute to rather sharply acute ..... 7. *I. hainanensis*
- 23b. Medium-sized shrubs, flowering at 1–3 m tall; leaves sharply acute to acuminate at apex; corollas with tube 20–25 mm, in bud sharply acute to acuminate ..... 9. *I. henryi*

**1. *Ixora auricularis*** Chun & F. C. How ex W. C. Ko, Guihaia 19: 99. 1999.

耳叶龙船花 er ye long chuan hua

Shrubs or small trees, to 6 m tall; branches glabrous. Leaves opposite, sessile or subsessile; blade drying thinly papery, brown adaxially, pale abaxially, oblanceolate, oblong-elliptic, or obovate-elliptic, 10–23 × 5.5–9 cm, glabrous on both surfaces, base cordate-auriculate, apex shortly acuminate; secondary veins 10–13 pairs; stipules ovate to broadly triangular, 7–18 mm, abruptly narrowed and aristate. Inflorescences

terminal, corymbose, 6–15 cm wide; peduncle 3–5 cm, articulate near base, at articulation with reduced leaves ca. 3 cm; bracteoles linear-lanceolate, ca. 1 mm; pedicels 2–3 mm. Flowers sessile or pedicellate. Calyx with hypanthium obconic; limb deeply lobed; lobes ligulate. Corolla purplish red; tube 20–30 mm, glabrous at throat; lobes oblanceolate-oblong, 7–7.2 × 3–3.5 mm, acute. Drupe globose, 6–8 mm in diam. Fl. May–Jun.

• Broad-leaved forests or thickets at middle elevations; ca. 1100 m. Yunnan.

The protologue text described the calyx “post anthesis” as 2–2.5 mm, but the protologue figure illustrated it as 4 mm at anthesis.

**2. *Ixora cephalophora*** Merrill, J. Arnold Arbor. 23: 194. 1942.

团花龙船花 tuan hua long chuan hua

Shrubs, 1–2 m tall; branches glabrous. Leaves opposite; petiole 1–2 cm, glabrous; blade drying olive-green adaxially, paler abaxially, elliptic-oblong, oblanceolate, or oblong-lanceolate, 10–25(–30) × 4–6(–8) cm, base cuneate, apex obtuse to broadly acuminate; secondary veins 9 or 10 pairs; stipule broadly ligulate to ovate, 3–5 mm, obtuse to rounded with arista ca. 3 mm. Inflorescences subsessile, congested-cymose to congested-corymbiform, ca. 17 × 9 cm; secondary axes 1–1.2 cm; bracts oblong-lanceolate to lanceolate, 2.5–5 mm, acuminate; pedicels 1–2 mm. Flowers sessile or pedicellate. Calyx with hypanthium subglobose, 1.5–2 mm; limb lobed deeply; lobes oblong-lanceolate to lanceolate, 4–5 × 1.5–2 mm, obtuse to acute. Corolla white; tube 20–25 mm, glabrous at throat; lobes elliptic or elliptic-oblong, 5–6 × 2.5–4 mm, obtuse to rounded. Drupe reddish yellow to red, subellipsoid and weakly compressed, ca. 11 × 9 mm. Fl. May, fr. Sep.

Thickets or shady broad-leaved forests at low elevations, or sometimes on open sandy lands. Guangxi, Hainan, Yunnan [Indochina, Philippines].

**3. *Ixora chinensis*** Lamarck, Encycl. 3: 344. 1789.

龙船花 long chuan hua

*Gaertnera hongkongensis* Seemann; *Ixora crocata* Lindley; *I. stricta* Roxburgh; *I. stricta* var. *incarnata* Benthams; *Pavetta kroneana* Miquel; *Sykesia hongkongensis* (Seemann) Kuntze; *Tsiangia hongkongensis* (Seemann) But, H. H. Hsue & P. T. Li.

Shrubs, 0.8–2 m tall; branches glabrous. Leaves opposite, sometimes apparently in whorls of 4 due to reduced stem internodes, sessile or petiolate; petiole to 5 mm, glabrous; blade drying leathery, oblanceolate, oblong-oblanceolate, obovate, elliptic-oblong, or lanceolate, 6–18 × 3–6 cm, glabrous on both surfaces, base cuneate to shortly truncate or rounded, apex obtuse or rounded to acute; secondary veins 7–9 pairs; stipules persistent, united around stem to almost interpetiolar, triangular to broadly triangular, 3–7 mm, glabrous to glabrescent, costate, acute and with arista 2–10 mm. Inflorescence terminal, congested-cymose to congested-corymbiform, many flowered, puberulent to hirtellous, subsessile to pedunculate; peduncle to 1.5 cm, often subtended by 2 reduced leaves or leaflike bracts; branched portion 1–4 × 1–5 cm (not including corollas); bracts triangular, 0.2–1 mm; pedicels to 2 mm. Flowers subsessile to pedicellate. Calyx glabrous; hypanthium obconic to ovoid, 1–1.5 mm; limb deeply lobed; lobes triangular to ligulate, 0.5–1 mm, acute or obtuse. Corolla red or reddish yellow, outside glabrous; tube 20–30 mm, glabrous in throat; lobes ovate, elliptic, or broadly elliptic, 5–7 × 4–5 mm, broadly obtuse to rounded. Drupe reddish black, subglobose and shallowly didymous, 6–7 × 6–7 mm, glabrous. Fl. May–Jul and Dec, fr. Sep–Oct.

Thickets, sparse forests; 200–800 m. Fujian, Guangdong, Guangxi [Indonesia, Malaysia, Philippines, Vietnam; widely cultivated in tropical regions].

This is a commonly collected species of *Ixora* in China, apparently growing naturally as well as in cultivation. The occasional short stem internodes, which sometimes produce congested groups of leaves, appear to possibly be due to a change in growth pattern at the top of a seasonal spurt that includes several internodes. The circumscription and characters of this species were considered in some detail by Fosberg and Sachet (Baileya 23(2): 77. 1989), who noted that it is sometimes cultivated. Bridson (Kew Bull. 55: 1011–1012. 2000) studied the identity of *Tsiangia*, and formally synonymized its only species, *T. hongkongensis*, with *I. chinensis*.

**4. *Ixora effusa*** Chun & F. C. How ex W. C. Ko, Fl. Hainan. 3: 580. 1974.

散花龙船花 san hua long chuan hua

Shrubs, ca. 1 m tall; branches glabrous. Leaves opposite; petiole 0.5–1 cm, glabrous; blade drying thinly papery to papery and olive-greenish brown, oblanceolate to oblong, 10–18 × 3–7 cm, both surfaces glabrous, base cuneate to obtuse, apex acute or obtuse; secondary veins 8 or 9 pairs; stipules persistent, shortly fused around stem to subinterpetiolar, triangular, 2–8 mm, glabrous, obtuse to acute with arista 2–9 mm. Inflorescence terminal, corymbiform, 7–11 cm wide, lax, with axes usually spreading at 45°–90°, glabrous; peduncle 0.5–4 cm, articulate and with reduced leaves near base; bracts linear, narrowly triangular, or ligulate, 0.5–5 mm; pedicels to 10 mm. Flowers sessile to pedicellate. Calyx glabrous; hypanthium turbinate, ca. 1 mm; limb deeply lobed; lobes lanceolate to ligulate, 1–1.4 mm, acute to rounded. Corolla white or pale purple; tube 7–11 mm, glabrous at throat; lobes narrowly lanceolate, 5–9 × ca. 2.3 mm, acute. Drupe subglobose, 8–9 mm in diam., glabrous. Fl. Apr–May.

Forests at middle elevations; ca. 500 m. Guangxi, Hainan [Vietnam].

**5. *Ixora finlaysoniana*** Wallich ex G. Don, Gen. Hist. 3: 572. 1834.

薄叶龙船花 bao ye long chuan hua

Shrubs or small trees, to 5–6 m tall; branches glabrous. Leaves opposite; petiole 4–10 mm, glabrous; blade drying rather leathery, elliptic-oblong, elliptic, oblanceolate, obovate, or oblong-lanceolate, 10–17(–20) × 3–6(–9) cm, glabrous on both surfaces, base cuneate to obtuse, apex obtuse to acute; secondary veins 8–12 pairs; stipules usually persistent, interpetiolar or usually united around stem, broadly ovate to triangular, 3–6 mm, glabrous, acute or with arista 0.3–3.5 mm. Inflorescences terminal, corymbiform to densely cymose, puberulent, subsessile to pedunculate; peduncle to 4.5 cm; branched portion 2.5–4 × 3–5 cm (not including corollas); bracts lanceolate, elliptic, or narrowly ligulate, 8–10 mm, obtuse to acute. Flowers sessile or subsessile. Calyx glabrous; hypanthium ellipsoid to subglobose, 1–1.5 mm; limb deeply lobed; lobes elliptic, narrowly elliptic, or oblanceolate, 4–6 mm, acute. Corolla white, outside glabrous; tube 20–30 mm, glabrous at throat; lobes narrowly elliptic to oblanceolate, 5–6 × 1.2–3 mm, acute to subacute. Drupe subglobose and often weakly didymous, 6–8 mm in diam., glabrous. Fl. Apr–Oct, fr. Sep.

Sparse forests at low elevations; 100–1100 m. Guangdong, Hainan, Yunnan [NE India (Assam), Indochina, Philippines, Thailand; widely cultivated in tropical zones worldwide].

The name of this species is sometimes spelled incorrectly as "*findlaysoniana*." This species is native in our region and also widely cultivated in warm tropical regions worldwide.

**6. *Ixora fulgens*** Roxburgh, Hort. Bengal. 10. 1814.

亮叶龙船花 liang ye long chuan hua

*Pavetta fulgens* (Roxburgh) Miquel.

Shrubs; branches glabrous. Leaves opposite; petiole 10–18 mm, glabrous; blade drying dark brown, shiny, oblong-lanceolate, lanceolate, elliptic, or narrowly elliptic, (9–)15–22 × (2–)3–4 cm, both surfaces glabrous, base cuneate to obtuse, apex acute to long acuminate; secondary veins 8–10 pairs; stipules persistent, shortly united around stem, ovate, 2–3 mm, acute with arista 3–5 mm. Inflorescences terminal, corymbose, 12–17 cm wide, puberulent to hirtellous; peduncle ca. 1 cm; bracts narrowly triangular, 1–1.5 mm; pedicels 0.5–3 mm. Flowers pedicellate. Calyx glabrescent; hypanthium ellipsoid, ca. 1.5 mm; limb lobed for up to ca. 1/2; lobes subtriangular, 0.5–1 mm, obtuse. Corolla orange-yellow to dark red, outside glabrous; tube 25–30 mm, in throat glabrous; lobes ovate, lanceolate, or elliptic, 10–12 mm, acute. Drupe globose, 9–10 mm in diam., glabrescent. Fl. Jul–Sep.

On wet soil in sparse forests. Yunnan [India, Indonesia, Myanmar, Philippines, Vietnam].

The application of this name has apparently varied among authors. Bremekamp (J. Bot. (London) 75: 111. 1937) discussed the differing usage, noting that the original description was based on a plant cultivated in the Calcutta Botanical Garden and of incorrectly attributed (in his view) provenance. Plants from the Philippines have petioles as short as 5 mm and corolla lobes up to 40 mm.

W. C. Ko (in FRPS 71(2): 42. 1999) described the branches as sometimes with epidermis strips peeling off; this has not been reported by others nor seen on specimens. Ko also described the secondary leaf veins as 18–25 pairs (p. 43); that count seems to include the often rather well-developed intersecondary veins together with the secondary veins.

**7. *Ixora hainanensis*** Merrill, Lingnan Sci. J. 6: 287. 1930.

海南龙船花 hai nan long chuan hua

*Ixora pygmaea* Merrill & F. P. Metcalf.

Shrubs, 0.2–3 m tall; branches glabrous. Leaves opposite; petiole 2–8 mm, glabrous; blade drying papery to subleathery, dry dark green, slightly shiny to matte, elliptic-oblong, elliptic, or oblanceolate, 4–10(–14) × 1–5 cm, glabrous on both surfaces, base cuneate, rounded, or subcordate, apex rounded, obtuse, or bluntly acute; secondary veins 5–10 pairs; stipules persistent, shortly united around stem or subinterpetiolar, triangular to ovate, 4–10 mm, glabrous, long acute with apical portion 3–10 mm, at least sometimes glandular at tip. Inflorescence terminal, corymbiform to cymose, many flowered, glabrous; peduncle 1–4 cm; branched portion 2–3 × 2–5 cm (not including corollas); bracts linear-oblong, 1–3.5 mm; pedicels 0.5–3 mm. Flowers pedicellate. Calyx glabrous; hypanthium ellipsoid to obconic, 1–1.5 mm; limb deeply lobed; lobes triangular to ovate or lanceolate, 1–1.5 mm, acute to acuminate. Corolla white, outside glabrous; tube 30–40 mm, villous in throat; lobes narrowly spatulate to oblanceolate, 6–7 × 1–2 mm, acute. Drupe red, subglobose to ellipsoid, weakly compressed and didymous, ca. 6 × 6–8 mm, glabrous. Fl. May–Dec, fr. Jan, Oct–Dec.

• On sandy soil at streamsides in dense forests; 100–1100 m. Guangdong, Hainan.

The name *Ixora pygmaea* was synonymized by W. C. Ko in FRPS (71(2): 43. 1999); Merrill and Metcalf in fact suggested in the protologue that it might only be a depauperate form of *I. hainanensis*. The leaves are rather variable in shape, usually on the same plant as noted in the protologue.

**8. *Ixora hekouensis*** Tao Chen, nom. nov.

河口龙船花 he kou long chuan hua

Replaced synonym: *Ixora gracilis* W. C. Ko, Guihaia 19: 103. 1999, not *Ixora gracilis* R. Brown ex Fawcett in H. O. Forbes, Nat. Wand. E. Archip. 508. 1885, nor *Ixora gracilis* (A. Richard ex Candolle) Kuntze, Revis. Gen. Pl. 1: 286–287. 1891 [*Pavetta gracilis* A. Richard ex Candolle, Prodr. 4: 492. 1830].

Climbing shrubs. Stems glabrous. Leaves opposite; petiole 4–6 mm; blade drying papery and grayish brown, elliptic-oblong to obovate, 10–18 × 3–7 cm, base cuneate to obtuse, apex rather abruptly contracted and acute to acuminate; secondary veins 7–9 pairs; stipules persistent, ovate, 6–7 mm, with arista slightly longer than stipule. Inflorescences terminal, corymbose, 7–8 × 3.5–5 cm, several flowered, puberulent; peduncle 3–5 cm; bracts narrowly lanceolate, 3.5–5 mm; pedicels 2–3 mm. Flowers pedicellate. Calyx puberulent; hypanthium subglobose, ca. 2 mm; limb deeply lobed; lobes triangular, 1–1.2 mm. Corolla white; tube 18–20 mm, glabrous at throat; lobes narrowly elliptic-oblong, 5–6 mm, obtuse. Drupe unknown. Fl. Jun–Aug.

• Dense forests at riversides; ca. 200 m. Yunnan (Hekou).

The reported climbing habit of this species is highly unusual in *Ixora*; however, W. C. Ko did not use that character in the protologue to help distinguish this species.

**9. *Ixora henryi*** H. Léveillé, Repert. Spec. Nov. Regni Veg. 13: 178. 1914.

白花龙船花 bai hua long chuan hua

Shrubs, 1–3 m tall; branches glabrous. Leaves opposite; petiole 3–7 mm, glabrous; blade drying papery, elliptic-oblong, lanceolate, lanceolate-oblong, or elliptic, 5–15 × 1.5–4 cm, glabrous on both surfaces, base cuneate, obtuse, or rounded, apex sharply acute to usually acuminate; secondary veins 7 or 8 pairs; stipules persistent or sometimes fragmenting, triangular to ovate, 5–8 mm, glabrous, shortly obtuse to narrowed and prolonged into arista 3–11 mm. Inflorescence terminal, corymbiform to congested-cymose, many flowered, glabrous; peduncle 0.4–1.5 cm; branched portion 1.5–4 × 2–7 cm (not including corollas); bracts linear or linear-lanceolate, 0.8–3 mm; pedicels to 2.5 mm. Flowers subsessile to pedicellate. Calyx glabrous; hypanthium ellipsoid, 1–1.8 mm; limb deeply lobed; lobes triangular, 0.5–1 mm, acute. Corolla white sometimes becoming dark red when dry, outside glabrous; tube 20–25 mm, glabrous in throat; lobes narrowly oblong to narrowly lanceolate, 5–6 × 1.6–2 mm, acute. Drupe subglobose, 8–10 mm in diam. Fl. Apr–Dec, fr. May–Jul.

Broad-leaved forests, streamsides at forest margins; 200–2000 m. Guangdong, Guangxi, Guizhou, Hainan, Yunnan [Thailand, Vietnam].

**10. *Ixora insignis*** Chun & F. C. How ex W. C. Ko, *Guihaia* 19: 97. 1999.

长序龙船花 chang xu long chuan hua

Small trees, height not noted; branches glabrous. Leaves opposite; petiole 7–10 mm; blade drying membranous, elliptic-oblong to oblong-oblong, 10–14 × 4–5 cm, glabrous, base cuneate, obtuse, or rounded, apex abruptly shortly acuminate; secondary veins 10–12 pairs; stipules triangular, 5–8 mm, with arista almost as long as sheath. Inflorescence terminal, corymbiform, puberulent; peduncle ca. 14 cm, articulate below middle, at articulation with pair of reduced leaves (or leaflike bracts) ovate to oblong-ovate, ca. 4 × 2.5 cm; branched portion 6–7 cm wide; secondary axes 1.5–1.8 cm; bracts linear-subulate, 0.5–3 mm; pedicels to 1.5 mm. Flowers sessile or pedicellate. Calyx puberulent; hypanthium obconic to ellipsoid, ca. 0.5 mm; limb deeply lobed; lobes narrowly elliptic-oblong, 1.3–1.5 mm, obtuse. Corolla in bud up to 2 cm with lobes up to 6 mm, obtuse. Drupe not seen. Fl. May.

- Mountains; ca. 1600 m. Yunnan (Hekou).

The “reduced leaves” borne on the peduncle that were mentioned in the protologue to characterize this species are called by some authors “foliaceous bracts.”

**11. *Ixora longshanensis*** Tao Chen, *nom. nov.*

龙山龙船花 long shan long chuan hua

Replaced synonym: *Ixora amplexicaulis* C. Y. Wu & W. C. Ko, *Guihaia* 19: 98. 1999, not *Ixora amplexicaulis* Gillespie, *Bull. Bernice P. Bishop Mus.* 74: 30. 1930.

Small trees, to 6 m tall; branches glabrous, drying brown. Leaves opposite, sessile; blade drying thinly leathery or thickly papery, brown, paler abaxially, elliptic to oblanceolate, (2–)13–15 × (1–)5–6 cm, glabrous on both surfaces, base cordulate and amplexicaul, apex acute to acuminate; secondary veins 10–15 pairs; stipules subulate to triangular, ca. 7 mm, glabrous, acute to acuminate. Inflorescence terminal, corymbiform, puberulent, red to purple-red; peduncle 1.5–3.5 cm, often articulate near base, at articulation bearing reduced leaves ca. 2 × 0.5–0.7 cm; secondary axes 2.5–3 cm; bracts subulate, 1.5–2 mm. Flowers subsessile to pedicellate. Calyx with hypanthium obconic, ca. 2 mm; limb deeply lobed; lobes triangular, obtuse. Corolla in bud red-purple; tube 8–9 mm or longer, glabrous at throat; lobes lanceolate, 4–5 mm or longer, cuneate. Drupe unknown.

- Dense forests in valleys or at streamsides. S Yunnan.

**12. *Ixora nienkui*** Merrill & Chun, *Sunyatsenia* 2: 324. 1935.

泡叶龙船花 pao ye long chuan hua

Shrubs, 1–3 m tall; branches glabrous. Leaves opposite; petiole 10–15 mm, glabrous; blade drying papery, oblong-lanceolate, elliptic-oblong, or oblong-oblong, 10–23 × 3–7 cm, both surfaces glabrous, sometimes shallowly bullate, base rounded, obtuse, or cordulate, apex acuminate to rather long acuminate; secondary veins 10–15 pairs; stipules deciduous, united around stem, 3–10 mm, glabrous, acute with arista 2–5 mm. Inflorescences terminal, corymbiform, many flowered, pu-

berulent, dark red, subsessile to shortly pedunculate; peduncle to 0.6 cm; secondary axes 1–2.5 cm; bracts linear-lanceolate to linear, 1–3 mm; pedicels 1–6 mm. Flowers pedicellate. Calyx glabrous; hypanthium ellipsoid, tube 1.5–1.8 mm; limb lobed nearly to base; lobes triangular, ca. 1 mm. Corolla white or pink, outside glabrous; tube 30–40 mm, glabrous at throat; lobes lanceolate, 5–7 mm, acute. Drupe bright red, globose, 7–8 mm in diam., glabrous. Fl. Jul–Oct, fr. Jun–Oct.

Woods, forested ravines, streamsides; 400–1000 m. Guangdong, Guangxi, Hainan [Vietnam].

**13. *Ixora paraopaca*** W. C. Ko, *Guihaia* 19: 101. 1999 [“*paraopara*”].

版纳龙船花 ban na long chuan hua

Shrubs, to 2 m tall; branches glabrous, lenticellate, striate. Leaves opposite; petiole 1–1.5 cm; blade drying thickly papery, opaque, dark green, oblong-lanceolate, 10–16 × 3–4.5 cm, base obtuse, apex cuneate, acute, or acuminate; secondary veins 14–16 pairs; stipules triangular, ca. 10 mm, acute with arista ca. 3 mm. Inflorescence terminal, corymbiform-cymose, 8–9 × 9–10 cm, puberulent; peduncle 0.1–0.5 cm; bracts linear-lanceolate to linear, 3–5 mm. Flowers sessile to subsessile. Calyx puberulent; hypanthium turbinate, ca. 2 mm; limb deeply lobed; lobes broadly triangular, ca. 1 mm, obtuse. Corolla red, outside glabrous; tube ca. 10 mm, glabrous inside; lobes narrowly oblong, 4–5 mm, obtuse to subrounded. Drupe unknown. Fl. Apr–Jun.

- Sparse forests on gentle hill slopes. Yunnan (Xishuangbanna).

This name was originally published with the spelling “*paraopara*,” a correctable typographical error as evidenced by the diagnosis, which states that this new species is related to *Ixora opaca* R. Brown ex G. Don. The protologue text described the corolla tube as 1 mm long, but this seems to be shown as 1 cm in the protologue figure.

**14. *Ixora philippinensis*** Merrill, *Philipp. J. Sci.*, C, 5: 238. 1910.

小仙龙船花 xiao xian long chuan hua

Shrubs or small trees; branches glabrous [to densely puberulent in Philippine plants]. Leaves opposite, sessile to shortly petiolate; petiole to 0.4 cm, glabrous [to densely puberulent in Philippine plants]; blade drying thinly papery and dark brown, elliptic, elliptic-oblong, or elliptic-ovate, 4.5–10 × 2–7 cm, glabrous [or puberulent along midrib abaxially in Philippine plants], base truncate, rounded, or cordulate, apex obtuse to rounded and usually apiculate; secondary veins 8–11 pairs; stipules deciduous, very shortly united around stem, lanceolate to broadly triangular, 2–5 mm, glabrous, acuminate. Inflorescences terminal, congested-cymose, 1–2 cm wide (not including corollas), few flowered, puberulent to glabrous; peduncle 1–1.5 cm, usually subtended by a pair of reduced, ovate or subovate, cordate leaves 0.5–3 cm; bracts ovate-lanceolate to narrowly triangular, 1.5–2 mm, acuminate. Flowers subsessile to sessile. Calyx puberulent to glabrescent; hypanthium ellipsoid, ca. 1 mm; limb 0.5–1 mm, shallowly lobed; lobes dentiform. Corolla white to pink, outside puberulent; tube 18–20 mm; lobes elliptic-oblong, ca. 7 × 3.5 mm, obtuse. Drupe ovoid, didymous, weakly compressed, ca. 1 cm, red when dry. Fl. Jun–Aug.

Broad-leaved forests. Taiwan [Philippines].

**15. *Ixora subsessilis*** Wallich ex G. Don, Gen. Hist. 3: 572. 1834.

囊果龙船花 nang guo long chuan hua

Shrubs or small trees, 2–2.5 m tall; branches glabrous. Leaves opposite, subsessile; blade drying thinly leathery, lanceolate, elliptic, or oblanceolate, 10–12 × 3–4 cm, glabrous on both surfaces, base obtuse, apex long acuminate; stipules glabrous, long acuminate with apex subulate or linear, longer than sheath. Inflorescences subsessile, corymbiform and trichotomous, several flowered; axes slender; bracts subulate or linear. Calyx with hypanthium ca. 1 mm; lobes linear, 0.8–1.3 mm. Corolla tube 13–45 mm, glabrous in throat; lobes narrowly elliptic-oblong, acute. Drupe saccate, 8–8.4 mm in diam.

Sparse forests; 1200–1500 m. Xizang (Mêdog) [India, S Thailand].

W. C. Ko (in FRPS 71(2): 33. 1999) described this species as highly variable, in particular in leaf shape, in the corolla tubes ranging 13–45 mm, and in the stigma varying from bilobed to entire; this range of variation is indeed rather unusual.

**16. *Ixora tibetana*** Bremekamp, J. Bot. 75: 261. 1937.

西藏龙船花 xi zang long chuan hua

Shrubs or small trees; branches glabrous, 2–2.5 mm in diam. Leaves opposite; petiole 0.65–0.8 cm, glabrous; blade drying green or markedly discolorous, opaque, elliptic or obovate, 15–17 × 6.5–7.5 cm, glabrous on both surfaces, base cuneate to acute, apex acuminate; secondary veins ca. 11 pairs; stipules shortly fused around stem, triangular, glabrescent except adaxially villous, aristate. Inflorescence terminal, corymbiform, tripartite, sparsely puberulent, 75–100-flowered; peduncle 0.7–0.8 cm, with reduced leaves at base; secondary axes 4.5–5 cm; bracts filiform, reduced; pedicels to 1 mm. Flowers sessile to shortly pedicellate. Calyx glabrous; limb lobed to base; lobes lanceolate, ca. 1.5 mm, subacute. Corolla white, glabrous throughout; tube ca. 24 mm; lobes ovate-lanceolate, ca. 5.5 × 2.5 mm, acute. Drupe unknown.

• 1200–1500 m. SE Xizang.

**17. *Ixora tsangii*** Merrill ex H. L. Li, J. Arnold Arbor. 24: 456. 1943.

上思龙船花 shang si long chuan hua

Small shrubs, to 1 m tall; branches glabrous. Leaves opposite; petiole 1–1.8 cm, glabrous; blade olive-green when fresh, drying papery and dark brown, oblong-lanceolate to elliptic, 7–20 × 2.5–6 cm, glabrous on both surfaces, shallowly bullate, base cuneate to obtuse, apex acute to long acuminate; secondary veins 9–16 pairs; stipules deciduous through fragmentation, interpetiolar or shortly united around stem, ovate to ligulate-triangular, 2–8 mm, glabrous, rounded with arista 2–6 mm. Inflorescences terminal, corymbiform, trichotomous, lax, sessile to subsessile, sparsely to densely puberulent; branched portion 3–3.5 × 3–3.5 cm; bracts linear-lanceolate to narrowly triangular, 1–3 mm, acuminate; pedicels 3–5 mm. Flowers pedicellate. Calyx glabrous; hypanthium ellipsoid, ca. 1.5 mm; limb deeply lobed; lobes ovate to triangular, ca. 1 mm, acute to acuminate. Corolla white, outside glabrous; tube 15–18 mm, glabrous at throat; lobes elliptic, ca. 5 mm, obtuse to subrounded. Drupe unknown. Fl. Sep.

• Shady thickets. Guangxi (Shangsi).

**18. *Ixora yunnanensis*** Hutchinson in Sargent, Pl. Wilson. 3: 412. 1916.

云南龙船花 yun nan long chuan hua

Shrubs, to 1 m tall, little branched; branches glabrous. Leaves opposite or ternate; petiole 2–10 mm, glabrous; blade drying papery, grayish green, narrowly oblanceolate or narrowly elliptic-oblong, 7–22 × 1–3(–4) cm, glabrous on both surfaces, base acute and decurrent, apex acute to long acuminate; secondary veins 12–15 pairs; stipules persistent, shortly united around stem, triangular to broadly ovate, 3–5 mm, glabrous, acute with arista 2–4.5 mm inserted below top of stipule, sometimes shortly bilobed. Inflorescences terminal, subsessile, corymbiform to congested-cymose, 2–4 × 2.5–4 cm (not including corollas), puberulent to glabrescent, subsessile to pedunculate; peduncle to 0.5 cm; bracts lanceolate to narrowly triangular, 2–6 mm, acute; pedicels to 2 mm. Flowers sessile to shortly pedicellate. Calyx puberulent; hypanthium turbinate, 1.5–2 mm; limb deeply lobed; lobes linear-lanceolate, 3–4 mm, subacute to acute. Corolla white; tube 30–40 mm; lobes narrowly elliptic-oblong, 6–7 × 2–2.5 mm, obtuse. Drupe red, ellipsoid-oblong, somewhat compressed and didymous, ca. 10 × 8 mm. Fl. May.

• Dense forests at humid riversides. Yunnan.

#### 40. *KEENANIA* J. D. Hooker, Fl. Brit. India 3: 101. 1880.

溪楠属 xi nan shu

Chen Tao (陈涛); Charlotte M. Taylor

Herbs or subshrubs, unarmed. Raphides apparently present. Leaves opposite, perhaps without domatia; stipules caducous or usually persistent, interpetiolar, triangular, usually aristate, sometimes somewhat inflated. Inflorescences terminal or sometimes pseudoaxillary, capitate, several to many flowered, pedunculate, bracteate with basalmost bracts usually involucrate and remaining bracts often well developed and paired. Flowers sessile, presumably bisexual, biology unknown. Calyx limb 4-, 5-, or sometimes 6-lobed with lobes sometimes unequal, sometimes imbricate in bud, sometimes gland-tipped. Corolla white or yellow, funnelliform with tube sometimes inflated, inside pubescent in upper part and throat; lobes 4, 5, or sometimes 6, ovate and acuminate, valvate in bud. Stamens 5, inserted at corolla base, included or partially exerted; filaments short to developed; anthers dorsifixed near base. Ovary 2-celled, ovules numerous in each cell on globose, peltate, axile placentas; stigma 2-lobed, included or exerted. Fruit unknown.

About five species: Cambodia, S China, India, Laos, Myanmar, Thailand, Vietnam; two species (one endemic) in China.

This genus is not well known or documented. Puff et al. (Rubiaceae of Thailand, 180. 2005) described the flowers as “unisexual (?),” though they did not say whether the plants are dioecious, and suggested that the fruit of *Keenania* will eventually be found to be capsular. The absence of raphides was implied by the placement of this genus in the Isertiae in FRPS (71(1): xiii. 1999), but raphides are clearly evident on specimens referred to *K. ophiorrhizoides* Drake from Vietnam (MO!) and thus are provisionally cited for the genus.

- 1a. Peduncles less than 0.5 cm; involucre bracts narrowly lanceolate or linear, 10–15 mm ..... 1. *K. flava*  
 1b. Peduncles 1–3.5 cm; involucre bracts orbicular, elliptic-oblong, or subovate, 6–7 mm ..... 2. *K. tonkinensis*

**1. *Keenania flava* H. S. Lo, sp. nov.**

黄溪楠 huang xi nan

Type: China. Guangxi: Napo, Xiahua, Baikan, on slope, 21 Apr 1977, C. X. Luo 3-5491 (holotype, GXMI – bar code 050450).

Validating Latin description: that of “*Koenameia* [sic!] *flava* Lo” (H. S. Lo, Bull. Bot. Res., Harbin 18: 282–283. 1998).

Suffrutescent unbranched herbs, to 50 cm tall; stems terete, sparsely to densely villous. Petiole 0.8–2.5 cm, villous; leaf blade drying papery, adaxially black, and abaxially pale, lanceolate to ovate, 5–12 × 2.5–4 cm, glabrous except pilose on principal veins, base cuneate to obtuse, apex acuminate or acute; secondary veins 5–9 pairs; stipules caducous, not seen. Peduncle less than 0.5 cm; involucre bracts several, narrowly lanceolate or linear, 10–15 mm, acuminate; bracteoles narrowly lanceolate or linear, 5–6 mm. Calyx with hypanthium portion ca. 1 mm; lobes 5, narrowly lanceolate, 1.4–2 mm, slightly unequal. Corolla in bud yellow, tubular, and with 5 sharp longitudinal ridges; tube ca. 3 mm; lobes 5, triangular, ca. 1 mm, winged abaxially, apex rostrate-incurved. Fruit not seen. Fl. Apr.

- Valleys. Guangxi (Napo).

This name was previously published by H. S. Lo (loc. cit.) but not validly so because no type was indicated (*Vienna Code*, Art. 37.1).

**2. *Keenania tonkinensis* Drake, Bull. Mus. Hist. Nat. (Paris) 1: 118. 1895.**

溪楠 xi nan

Suffrutescent herbs, to 30 cm tall; stems villosulous. Petiole 1–1.5(–4) cm, glabrescent; leaf blade drying thinly papery and abaxially yellowed, elliptic-oblong or elliptic, 4–6(–12) × 2–2.5(–5) cm, adaxially glabrous, abaxially glabrous or often sparsely villosulous, base acuminate or cuneate, apex acute; secondary veins 8–10 pairs; stipules triangular, ca. 8 mm, long acuminate. Peduncle 1–3.5 cm; involucre bracts orbicular, elliptic-oblong, or subovate, 6–7 mm. Calyx with hypanthium portion broadly obconical, ca. 1 mm; lobes 5, triangular, 4–5 × ca. 1.5 mm, veined. Corolla white; tube ca. 6 mm, slightly swollen at base, slightly constricted in throat; lobes 5, ca. 1 mm. Fruit not seen.

Dense forests in valleys. Guangxi (Longzhou) [N Vietnam].

This species name was published twice, first and validly in the place cited above, then later by Drake (in J. Bot. (Morot) 9: 217. 1895); this later work is sometimes incorrectly cited as the place of first publication.

**41. KELLOGGIA Torrey ex Bentham & J. D. Hooker, Gen. Pl. 2: 137. 1873.**

钩毛草属 gou mao cao shu

Chen Tao (陈涛); Friedrich Ehrendorfer

Herbs, perennial, sometimes slightly woody at base; rootstock slender, with short rhizomatous and somewhat woody branches and with ascending or erect stems. Raphides present. Leaves opposite, decussate, subsessile, without domatia; stipules persistent, interpetiolar, hardly fused to petioles, triangular to linear or ± irregularly divided and often mutifid to fimbriate. Inflorescences thyrsoid, with terminal and axillary branches at uppermost nodes, pedunculate cymes often with umbelliform flower groups, not rarely with new axes developing and older axes elongating making inflorescences expansive, lax, few to many flowered and bracteate; uppermost bracts often reduced to multifid or fimbriate stipules. Flowers pedicellate, bisexual, monomorphic. Calyx teeth 4 or 5, narrowly lanceolate, hardly fused at base. Corolla white to pink or red, funnellform, divided to ca. 1/2 into 4 or 5 lobes, glabrous inside and valvate in bud. Stamens 4 or 5, inserted in corolla throat, finally slightly exerted; filaments flattened; anthers dorsifixed near base. Ovary inferior, densely covered with hooked trichomes, 2-celled, ovules 1 in each cell, erect, basal; style with 2 short, linear stigmas, exerted. Fruit with calyx teeth ± persistent, schizocarpous, dividing into 2 oblong to ellipsoid, leathery and indehiscent mericarps, densely covered with hooked trichomes; each mericarp with 1 medium-sized, ellipsoid and plano-convex seed; endosperm fleshy; embryo large; cotyledons leaflike; radicle hypogeous.

Two species: disjunct, one in China and Bhutan, the other in W North America (Mexico, United States); one species in China.

In general aspect, *Kelloggia* resembles *Galium*, particularly with respect to the inferior ovary (hypanthium) developing into dry schizocarps covered with hooked trichomes. Presumably, these fruit disperse similarly to those of *Galium* as “stick-tights,” by attaching to animals. In contrast to *Galium* and other Rubiinae, *Kelloggia* has 3-colpate (and not polycolpate) pollen grains, calyx teeth, and not leaflike interpetiolar stipules, making sterile plants resemble *Nertera* and *Neanotis*. In spite of these differences, Robbrecht and Manen (Syst. & Geogr. Pl. 76: 85–146. 2006) have transferred *Kelloggia* from the tribe Paederieae to the tribe Rubieae as a monotypic and basal subtribe Kelloggiinae. We concur with this transfer but not with the inclusion of the totally different *Theligomum* into the Rubieae, which should be left in a separate tribe, Theligoneae (see also Bremer & Eriksson, Int. J. Pl. Sci. 170: 766–793. 2009). *Kelloggia* and all other Chinese Rubieae taxa have been briefly discussed and keyed out under *Galium* in the present volume.

All generic descriptions of *Kelloggia* give the number of calyx and corolla lobes as "4 or 5," implying that both conditions are equally common as apparently is the case in the North American species. However, all the Asian specimens studied have 5 calyx and corolla lobes, as shown in the FRPS illustration (71(2): 157, t. 41. 1999) and described by Springate et al. (Fl. Bhutan 2(2): 822. 1999).

The morphology, circumscription, biogeography, and molecular phylogeny of *Kelloggia* were studied by Nie et al. (Amer. J. Bot. 92: 642–452. 2005). They concluded that the two species of the genus are most closely related to each other, that *Kelloggia* arrived in North America through long-distance dispersal from Asia, and that it occupies a basal position within Rubieae.

**1. *Kelloggia chinensis*** Franchet, J. Bot. (Morot) 6: 11. 1892.

云南钩毛草 yun nan gou mao cao

*Galium aberrans* W. W. Smith.

Herbs, perennial, to 30 cm tall. Stems flattened to subterete, puberulent to villosulous or hirtellous. Leaves subsessile or with petiole to 1 mm; blade drying thinly papery and blackish, narrowly lanceolate to narrowly elliptic, oblanceolate, or obovate, 5–15 × 2–5 mm, adaxially sparsely strigillose to villosulous, abaxially glabrous except sparsely to densely puberulent to hirtellous along midrib, base cuneate to acute, apex obtuse to acute; 1 main vein, secondary veins not or hardly visible; stipules 1.5–4 mm, often irregularly 3–7-lobed, triangular to linear, tomentulose or villosulous to glabrescent. Inflorescences

1–12 cm, axes strigillose to villosulous, 3–20-flowered; bracts stipuliform, 1–2 mm; pedicels 2–3 mm. Calyx split essentially to base, lobes 5, narrowly triangular, 0.5–1 mm. Corolla white to pink or red, outside puberulent or hispidulous; tube 2–2.5 mm; lobes 5, lanceolate, 2–2.5 mm, acute. Ovary ellipsoid, 1–1.5 mm, densely hairy with hooked trichomes 0.5–1 mm. Mericarps ovoid, ca. 2.5 mm, densely covered with hooked trichomes of 0.5–1 mm. Fl. Jul, fr. Jul–Sep.

Dry to wet mountain grasslands, along trails, forest and thicket openings; 3000–3700 m. Sichuan, Xizang, Yunnan [Bhutan].

Springate et al. (Fl. Bhutan 2(2): 822. 1999) noted that this species was collected once in Bhutan, at 3680 m, and that it is known from Xizang also. We have seen no material or other citations from Xizang, but this distribution seems reasonable and is added here.

**42. KNOXIA** Linnaeus, Sp. Pl. 1: 104. 1753.

红芽大戟属 hong ya da ji shu

Chen Tao (陈涛); Charlotte M. Taylor

*Vissadali* Adanson.

Annual or perennial herbs or subshrubs, unarmed. Raphides present. Leaves opposite or sometimes ternate, without domatia; stipules persistent or deciduous, interpetiolar and fused to petioles and/or shortly united around stem, 2–6-lobed or -setose, with apices of segments or setae usually glandular. Inflorescences terminal, thyriform, subcapitate, cymose, or often corymbiform with axes sometimes elongating and becoming racemiform with age, several to many flowered, pedunculate or sessile, bracteate. Flowers sessile or pedicellate, bisexual, distylous. Calyx limb 4-lobed; lobes sometimes unequal. Corolla white, pink, lilac, or violet, funnel-form, salverform, or tubular, with shape sometimes differing between long-styled and short-styled forms, lanate inside tube; lobes 4, valvate in bud. Stamens 4, inserted in corolla throat or near middle of corolla tube, included or exserted; filaments short; anthers dorsifixed. Ovary 2-celled, ovules 1 in each cell, pendulous, apical; stigma 2-lobed, exserted or included. Fruit schizocarpous, ovoid to ellipsoid, sometimes laterally compressed and/or didymous, dry, with calyx limb persistent; mericarps 2, ellipsoid, indehiscent, with 1 seed, early to tardily separating from base upward and falling together with or separately from a carpophore, with carpophore variously filiform and basal to comprising entire enlarged septum; seeds medium-sized, oblong-ellipsoid, compressed; testa thin; endosperm fleshy; cotyledons thin; radicle ascending.

Seven to nine species: tropical Asia and Oceania; two species in China.

*Knoxia* was revised by Bhattacharjee and Deb (J. Econ. Taxon. Bot. 6(1): 73–96. 1985), who recognized seven species. Then, it was reviewed anecdotally by Puff and Robbrecht (Bot. Jahrb. Syst. 110: 511–558. 1989), who circumscribed it differently and included nine species. The treatment by W. C. Ko (in FRPS 71(2): 3–7. 1999) differed markedly from these others; it did not cite these authors so presumably Ko had not seen their works. In particular, these other authors considered *K. sumatrensis* to be a wide-ranging, morphologically variable species and included as synonyms of var. *sumatrensis* two species that were separated by Ko, *K. corymbosa* and *K. mollis*. Because it was based on geographically broader studies of more literature and many more specimens from the type regions, Puff and Robbrecht's taxonomy is used here.

W. C. Ko (loc. cit.: 4) described the fruit as capsules and the seeds as having a thick stipe, but the fruit of *Knoxia* have more often been described within Rubiaceae as schizocarps with carpophores, as noted here.

- 1a. Herbs with rather large, fleshy, fusiform roots; leaves sessile or subsessile, blade lanceolate or oblong-lanceolate, 7–10 × 3–5 cm, with secondary veins 5–7 pairs; peduncles 3–12 cm; corolla tube 3–4 mm; fruit oblong-ellipsoid and somewhat didymous ..... 1. *K. roxburghii*
- 1b. Herbs or subshrubs with slender fibrous roots; leaves subsessile to petiolate with petioles to 12 mm, blade elliptic-oblong, elliptic, or lanceolate, 3–12 × 0.8–3.5 cm, with secondary veins 6–9 pairs; peduncles 0.3–2 cm; corolla tube 1.5–2 mm; fruit ellipsoid ..... 2. *K. sumatrensis*

**1. *Knoxia roxburghii*** (Sprengel) M. A. Rau, Bull. Bot. Surv. India 10(Suppl. 2): 40. 1969.

红大戟 hong da ji

*Spermacoce roxburghii* Sprengel, Syst. Veg. 1: 404. 1824;  
*Knoxia valerianoides* Thorel ex Pitard.

Erect herbs, 30–70 cm tall; root sometimes purple, rather

enlarged, fleshy, fusiform; branches subquadrate, becoming channeled, puberulent or villosulous becoming glabrescent. Leaves sessile or subsessile, opposite or often ternate; blade drying papery, lanceolate or oblong-lanceolate, 7–10 × 3–5 cm, both surfaces glabrescent or usually hispidulous to pilosulous or strigillose at least on principal veins, base acute to rounded, apex obtuse to acuminate; secondary veins 5–7 pairs, usually indistinct; stipules persistent, shortly fused to petioles or united around stem, linear to narrowly triangular or sometimes shortly to deeply 2- or 3-lobed, 8–10 mm, villosulous to glabrescent, acute. Inflorescences congested-cymose to subcapitate, puberulent or villosulous to glabrescent, ebracteate; peduncles 3–12 cm; dense flower groups 1–1.5 × 1–2.5 cm, borne singly or 3–5 on cymose axes; pedicels 0.5–1 mm. Calyx glabrescent; ovary portion ellipsoid, ca. 0.5 mm; limb deeply lobed; lobes triangular, 0.1–0.5 mm, often unequal on an individual flower. Corolla red, purplish red, or white, salverform or tubular, externally densely villosulous or glabrous; tube 3–4 mm; lobes triangular to ovate, ca. 1 mm. Schizocarps oblong-ellipsoid, somewhat didymous, laterally somewhat flattened, ca. 1.5 mm; mericarps separating from each other and carpophore; carpophore persistent, linear, ca. 1.3 mm.

Grasslands on mountain slopes. Fujian, Guangdong, Guangxi, Hainan, Yunnan, Zhejiang [Cambodia, India, Myanmar, Nepal, Thailand].

Bhattacharjee and Deb (J. Econ. Taxon. Bot. 6(1): 85. 1985) apparently included the Chinese plants within their circumscription of *Knoxia roxburghii* var. *brunonis* (Wallich ex G. Don) R. Bhattacharjee & Deb, which falls into *K. roxburghii* as circumscribed by Puff and Robbrecht (Bot. Jahrb. Syst. 110: 511–558. 1989). This name is based on *Spermacoce brunonis* Wallich ex G. Don (Gen. Hist. 3: 621. 1834). W. C. Ko (in FRPS 71(2): 4. 1999, as *K. valerianoides*) described the corollas of this species as salverform and densely pubescent externally; however, the corollas of Thai plants of this species are more tubular and are glabrous externally.

**2. *Knoxia sumatrensis* (Retzius) Candolle, Prodr. 4: 569. 1830.**

红芽大戟 hong ya da ji

*Spermacoce sumatrensis* Retzius, Observ. Bot. 4: 23. 1786; *Knoxia corymbosa* Willdenow; *K. mollis* Wight & Arnott.

Herbs or subshrubs, 20–90(–100) cm tall; roots slender, fibrous; branches terete to weakly quadrate, puberulent or villosulous to densely tomentulose. Leaves opposite, subsessile or petiolate with petiole to 12 mm, puberulent or villosulous to glabrescent; blade papery to membranous, elliptic, lanceolate, or elliptic-oblong, 3–12 × 0.8–3.5 cm, both surfaces hispid-pilosulous to villosulous or sometimes glabrescent adaxially, base acute to cuneate, apex acuminate to cuspidate; secondary veins 6–9 pairs; stipules persistent, shortly fused to petioles, deeply 3–5-lobed, 3–7 mm, villosulous to glabrescent, lobes sometimes setose. Inflorescences congested-cymose to corymbiform, sometimes trichotomous, 1–6 cm, densely strigillose to villosulous, ebracteate; peduncle 0.3–2 cm; pedicels 0.1–1 mm. Calyx puberulent or strigillose to glabrous; ovary portion ellipsoid, 0.5–0.8 mm; limb lobed essentially to base; lobes triangular, 0.1–0.3 mm, equal to subequal on an individual flower. Corolla white or purplish red, funnellform, outside glabrous; tube 1.5–2 mm; lobes triangular, ca. 1 mm. Schizocarps ovoid to ellipsoid, 2–3 mm, weakly 4–8-ribbed, strigillose or puberulent to glabrescent; mericarps coherent at dispersal; carpophore persistent, linear, ca. 2.5 mm. Fl. Jul–Aug, fr. Oct–Nov.

Thickets in open fields of low elevations. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Taiwan [India, Indonesia, Japan (Ryukyu Islands), Malaysia, Myanmar, Nepal, New Guinea, Philippines, Thailand, Vietnam; Australia].

W. C. Ko (in FRPS 71(2): 5. 1999) reported several unusual features for *Knoxia mollis* in China: calyx lobes ca. 1 mm, corolla bright green or rarely white, and corolla tube ca. 1 mm. These features have not been confirmed on any specimens studied for this treatment nor reported by other authors for *Knoxia* in SE Asia.

**43. LASIANTHUS Jack, Trans. Linn. Soc. London 14: 125. 1823, nom. cons., not Adanson (1763).**

粗叶木属 cu ye mu shu

Zhu Hua (朱华); Charlotte M. Taylor

*Dasus* Loureiro; *Litosanthes* Blume; *Mephitidia* Reinwardt ex Blume.

Erect subshrubs, shrubs, or rarely small trees, unarmed, with tissues sometimes fetid. Branches and branchlets terete, sometimes compressed, rarely fistulose; lenticels inconspicuous or conspicuous. Raphides present. Leaves opposite, distichous, usually thinly leathery or papery, base acute to rounded or cordate, apex acuminate, acute or cuspidate; midrib plane, depressed or slightly prominent adaxially, usually prominent abaxially; veins generally prominent abaxially, ascending at an angle of more than 45°, curved to margin or joining nerves above at margin; tertiary nervules parallel or reticulate; stipules caducous or usually persistent at least near stem apex, interpetiolar, well developed or reduced, triangular, lanceolate, ovate, or oblong, acute or obtuse. Inflorescence axillary, several flowered and glomerulate, capitate, cymose, or with flowers solitary, sessile or pedunculate, ebracteate or bracteate with bracts persistent or not, well developed, sometimes fused. Flowers bisexual, small, sessile or pedicellate. Calyx with hypanthium portion obovoid, ovoid, or campanulate; limb 3–6-dentate or lobed or rarely truncate. Corolla white, funnellform or salverform to urceolate (*Lasianthus biflorus*), from several millimeters long up to 2.5 cm, glabrous or hairy outside, inside glabrous or usually villous in throat; lobes 4–6, valvate or imbricate in bud. Stamens 4–6, inserted in corolla throat; filaments short; anthers linear or oblong, dorsifixed, included or exerted. Style linear; stigma lobes 3–9, linear or lanceolate, included or exerted. Ovary 3–9-celled, ovules 1 in each cell, basal, erect. Fruit blue or rarely white, black, or red, drupaceous, small, pulpy or fleshy, usually globose, smooth or warty, rounded or ridged, with calyx limb persistent; pyrenes 3–9 (sometimes fewer than that developing), thick walled,

smooth, warty or sulcate on abaxial face, usually triangular in transverse section, with preformed germination slits; seed black, with abundant endosperm; embryo straight; cotyledon short, flattened; radicle long clavate.

About 184 species: 160 species in tropical Asia, ca. 20 in Africa, three in tropical America, and one in Australia; 33 species (seven endemic) in China.

*Lasianthus* is commonly collected in China. This genus has been studied in detail by H. Zhu for both China (Acta Phytotax. Sin. 32: 49–81. 1994; Syst. & Geogr. Pl. 72: 63–110. 2002; Acta Bot. Yunnan. 30: 308–314. 2008) and Thailand (Acta Phytotax. Sin. 39: 116–150. 2001: 53 species included). As Zhu detailed (loc. cit. 2002: 63), the characters that distinguish species of *Lasianthus* are mostly small and/or subtle, frequently ephemeral, and often difficult to see; and, consequently, the taxonomy of this genus is complicated. *Lasianthus* can be confused with some species of *Dammacanthus*, *Diplospora*, *Prismatomeris*, *Saprosma*, and *Urophyllum*, especially when collected only with young flower buds. *Lasianthus* (Chinese species) is rather distinctive vegetatively in its combination of leaf blades that are completely glabrous adaxially, petioles that are usually densely pubescent even when other parts of the plant are glabrescent or only sparsely pubescent, and small stipules that are usually persistent and also densely pubescent.

The leaf venation of *Lasianthus* frequently has a characteristic regular pattern, comprising subparallel or exceptionally regularly oriented tertiary veins (“nervules”). This is different, however, from the lineolate quaternary venation found in *Antirhea*, *Timonius*, and some other genera. A similar arrangement is found in some species of *Urophyllum*. Cai et al. (Acta Bot. Yunnan. 29: 497–512. 2007) studied leaf details of *Lasianthus* and [broadly] related genera, and Cai et al. (J. Syst. Evol. 46(1): 62–72. 2008) studied the pollen of a similar group.

The genus *Litosanthes* has been variously treated as a genus with one to several species, or included in *Lasianthus*. H. S. Lo (in FRPS 71(2): 106–108. 1999) treated *Litosanthes* as a separate genus of one or two species, as did Puff et al. (Rubiaceae of Thailand, 102. 2005). However, H. Zhu (loc. cit. 2002: 69) included it as a synonym of *Lasianthus*, as done here, based on morphological and molecular evidence.

*Lasianthus verrucosus* H. S. Lo (Bot. J. S. China 2: 2. 1993; type specimen: China. Hainan: Ledong, *Q. Huang 820468*, SCBI) was not seen. From H. S. Lo’s description and figure of this species, it has leaves with a looped venation, glabrous and fuscous when drying; inflorescence sessile or subsessile; calyx limb with 4 small, broadly triangular lobes; and pyrenes 4, verrucose on the abaxial face. Many *Lasianthus* specimens from Hainan were examined, but none was found matching the description of *L. verrucosus*. Consequently, this species is excluded from this account. From the original description it appears to be most similar to *Saprosma merrillii* and thus would likely key out as that species.

The phylogenetic relationships among species of *Lasianthus* and related genera were studied based on molecular data by Xiao and Zhu (Bot. Stud. (Taipei) 48: 227–232. 2007). Their results supported the inclusion of *Litosanthes biflora* and *Saprosma crassipes* within *Lasianthus*. *Litosanthes* is accordingly included here. However, *S. crassipes* has a 2-locular ovary and 2-pyrene drupes, which do not match the current circumscription of *Lasianthus*. *Saprosma merrillii* seems similar to *S. crassipes*, and their systematic position needs further study.

*Lasianthus cyanocarpus* Jack was reported from China by the *Flora of Japan*. However, true *L. cyanocarpus* has a restricted distribution in S Thailand and Malesia. This name is therefore misapplied in China and Japan, where the correct name for the species is *L. hirsutus*.

The following species was recorded from China but could not be treated here because no material was seen by the present authors: *Lasianthus areolatus* Dunn (J. Bot. 47: 376. 1909), recorded from Guangdong by Merrill and Chun (Sunyatsenia 1(1): 49. 1930).

- 1a. Flowers in pedunculate congested cymes or subcapitate groups (though shortly pedunculate in *L. chunii* and sometimes subsessile in *L. japonicus*).
  - 2a. Peduncles slender, 0.5–3 cm.
    - 3a. Leaves more than 3 cm; flowers 5-merous; pyrenes 5 ..... 12. *L. filipes*
    - 3b. Leaves less than 3 cm; flowers 4-merous; pyrenes 2 or 4 ..... 5. *L. biflorus*
  - 2b. Peduncles short, 0.1–0.4 cm, or if more than 0.6 cm then robust.
    - 4a. Peduncles very short, 1–2 mm.
      - 5a. Branches and leaves abaxially appressed pubescent; leaves usually elliptic, acute or acuminate at apex, with nervules conspicuously elevated abaxially; fruit with 5 or 6 longitudinally elevated angles or ribs, strigillose ..... 10. *L. chunii*
      - 5b. Branches and leaves glabrous, or branches sparsely strigose when young and leaves abaxially strigose or hirtellous; leaves usually lanceolate, long caudate at apex, with nervules slightly prominent abaxially; fruit smooth, glabrous ..... 20. *L. japonicus*
    - 4b. Peduncles conspicuous, 1.5–20 mm.
      - 6a. Bracts numerous, linear, 6–12 mm ..... 26. *L. rhinocerotis*
      - 6b. Bracts 2 and less than 1 cm, or reduced and apparently absent.
        - 7a. Branches depressed pubescent or subglabrous; peduncles relatively robust, 5–20 mm; bracts linear, 3–10 mm; calyx more than 5 mm with ovate-lanceolate lobes; corolla more than 1.5 cm ..... 4. *L. biermannii*
        - 7b. Branches sparsely puberulent to glabrous; peduncles slender, 1.5–5 mm; bracts 2 mm or shorter, usually inconspicuous; calyx less than 2.5 mm with triangular or subulate lobes; corolla 8.5 mm or shorter ..... 24. *L. micranthus*
  - 1b. Flowers solitary or in sessile fascicles or glomerules (though sometimes pedunculate in *L. henryi*).
    - 8a. Bracts conspicuous.

- 9a. Leaves slightly cordate to rounded and often oblique at base.
- 10a. Branches and leaves tomentose or setose; leaves 5–12 cm; stipules inconspicuous or to ca. 3 mm ..... 1. *L. attenuatus*
- 10b. Branches and leaves glabrous, except very young branches subglabrous and leaves sparsely hairy on nerves abaxially; leaves 11–18 cm; stipules 5–6 mm ..... 27. *L. rigidus*
- 9b. Leaves cuneate or subrounded and not oblique at base.
- 11a. Branches and leaves hirsute; bracts large, leaflike ..... 16. *L. hirsutus*
- 11b. Branches and leaves glabrous or villous or appressed pubescent; bracts not leaflike.
- 12a. Branches glabrous or thinly puberulent, leaves glabrous; bracts orbicular, leathery ..... 19. *L. inodorus*
- 12b. Branches and leaves abaxially tomentose, villous, or densely appressed pubescent; bracts not orbicular, papery.
- 13a. Leaves usually no more than 10 cm; bracts small, subulate; fruit with 4 pyrenes ..... 28. *L. schmidtii*
- 13b. Leaves more than 12 cm; bracts ovate, lanceolate or linear; fruit with 5 or 6 pyrenes.
- 14a. Stipules not conspicuous; bracts linear to lanceolate, up to 2 cm; fruit glabrous ..... 30. *L. sikkimensis*
- 14b. Stipules triangular, up to 8 mm; outer bracts ovate and inner ones lanceolate, none more than 5 mm; fruit hairy.
- 15a. Pubescence appressed on branches, leaves abaxially, stipules, bracts, and calyx, drupes subglabrous ..... 9. *L. chrysoneurus*
- 15b. Tomentum dense and spreading on branches, leaves abaxially, stipules, bracts, calyx, and drupes ..... 25. *L. obscurus*
- 8b. Bracts inconspicuous or absent.
- 16a. Calyx lobes linear, longer than 5 mm.
- 17a. Leaves 11–16 × 3.5–5.5 cm; lateral veins more than 10 pairs; branches and nerves abaxially densely yellow villous; calyx lobes equal in length and 9–14 mm ..... 7. *L. chevalieri*
- 17b. Leaves 7–11 × 2.5–3 cm; lateral veins 5 or 6 pairs; branches and nerves abaxially hirsute; calyx lobes unequal in length, with longer ones up to 8 mm ..... 22. *L. linearisepalus*
- 16b. Calyx lobes not linear, no more than 5 mm.
- 18a. Calyx lobes longer than calyx tube or as long as tube.
- 19a. Leaves more than 12 cm.
- 20a. Branches, leaf nerves abaxially, calyx, corolla, and fruit strigillose to glabrescent; calyx lobes linear-lanceolate ..... 6. *L. calycinus*
- 20b. Branches, leaf nerves abaxially, and fruit tomentose with relatively long brown or fuscous hairs, calyx and corolla densely brown tomentose; calyx lobes oblong ..... 33. *L. wardii*
- 19b. Leaves less than 12 cm.
- 21a. Branches and leaf nerves abaxially glabrous or sparsely strigose; fruit glabrous ..... 23. *L. lucidus*
- 21b. Branches and leaves abaxially very hairy; fruit pubescent.
- 22a. Calyx limb divided nearly to base, lobes lanceolate or oblong and much longer than tube.
- 23a. Young branches and leaves abaxially appressed pubescent; calyx lobes oblong to elliptic or oblanceolate, obtuse at apex ..... 2. *L. austrosinensis*
- 23b. Branches and leaves abaxially densely spreading villous; calyx lobes lanceolate, acuminate at apex ..... 11. *L. curtisii*
- 22b. Calyx limb not divided to base, lobes linear-lanceolate, slightly longer than or almost as long as tube.
- 24a. Branches and leaves abaxially densely spreading villous ..... 14. *L. formosensis*
- 24b. Branches and leaves abaxially densely appressed pubescent ..... 15. *L. henryi*
- 18b. Calyx lobes clearly shorter than tube.
- 25a. Calyx lobes or teeth small, ovate and reflexed; leaves usually with more than 10 pairs of nerves, veinlets conspicuously reticulate ..... 8. *L. chinensis*
- 25b. Calyx lobes or teeth not ovate and not reflexed; leaves usually with less than 10 pairs of nerves, veinlets parallel or subparallel or subreticulate.
- 26a. Calyx cupulate, with limb truncate or minutely dentate; fruit crowned by enlarged calyx limb ..... 32. *L. verticillatus*
- 26b. Calyx with conspicuous lobes; fruit crowned by persistent calyx lobes but these not enlarged.
- 27a. Stipules triangular-lanceolate to linear-lanceolate, equal to or more than 3 mm, strigillose or hirsute; young branches strigillose or hirsute.
- 28a. Stipules 3–5 mm; flowers 5-merous; fruit smooth, pyrenes 5 ..... 29. *L. simizui*

- 28b. Stipules usually more than 5 mm; flowers 4-merous; fruit verrucose, pyrenes 4 ..... 31. *L. trichophlebus*
- 27b. Stipules triangular, less than 3 mm, puberulent; young branches puberulent or pubescent.
- 29a. Leaves more than 12 cm, lanceolate or oblong, lateral veins 6–9 pairs.
- 30a. Leaves oblong, lateral veins 6–8 pairs, veinlets subparallel, conspicuously elevated abaxially; branches densely appressed pubescent, leaves abaxially at nerves and margins puberulent or ciliate ..... 18. *L. hookeri*
- 30b. Leaves lanceolate to elliptic-lanceolate, lateral veins ca. 9 pairs, veinlets subreticulate with forks very slender; branches and leaf nerves abaxially sparsely appressed puberulent ..... 21. *L. lancifolius*
- 29b. Leaves less than 11 cm, ovate or ovate-oblong, lateral veins 4–6 pairs.
- 31a. Leaves 4–6 cm, less than 3 cm wide; branches and leaf nerves abaxially densely appressed hirsute ..... 3. *L. austroyunnanensis*
- 31b. Leaves 6–10 cm, as narrow as 2 cm but usually more than 3 cm wide; branches and leaf nerves abaxially glabrous or pubescent or villous.
- 32a. Branches and leaf nerves abaxially glabrous or sparsely appressed pubescent; calyx sparsely pubescent, with 5 triangular teeth; fruit glabrous ..... 13. *L. fordii*
- 32b. Branches and leaves abaxially densely villous; calyx densely strigillose, with 5 minute and broadly triangular teeth; fruit strigillose ..... 17. *L. hispidulus*

**1. *Lasianthus attenuatus*** Jack, Trans. Linn. Soc. London 14: 126. 1823.

斜基粗叶木 xie ji cu ye mu

*Lasianthus densifolius* Miquel; *L. setosus* Craib; *L. wallichii* Wight; *L. wallichii* var. *hispidocostatus* H. Zhu.

Shrubs, 1–2 m tall; branches and branchlets densely tomentose to hirsute or sometimes setose. Petiole 1–3 mm, tomentose to hirsute; leaf blade leathery or subleathery, oblong, elliptic-lanceolate, or oblong-ovate, 5–12 × 2.5–5 cm, glabrous adaxially, strigillose to hirtellous or tomentose abaxially, base slightly cordate or rarely rounded, slightly to markedly oblique, apex acute to cuspidate-acuminate; lateral veins 6–8 pairs; nervules subparallel, conspicuous abaxially; stipules triangular or ovate-lanceolate, 2–3 mm, tomentose to hirsute, apparently persistent. Inflorescence cymose or glomerulate, sessile, densely hirsute to hirtellous; bracts subulate to lanceolate, 6–15 mm, persistent. Flowers sessile. Calyx densely hirsute; hypanthium portion campanulate, ca. 1 mm; limb 1–2 mm, with 5 triangular teeth. Corolla sparsely hirtellous, puberulent to glabrescent outside, villous inside; tube 8–10 mm; lobes 5, spatulate, 4–5 mm. Fruit globose or ovoid, 5–10 mm in diam., densely hirsute, smooth; pyrenes 5 or 6. Fl. Apr, fr. Aug–Sep.

Forests, shaded and wet places; 200–1800 m. Fujian, Guangdong, Guangxi, Hainan, Taiwan, Yunnan [Bhutan, Cambodia, NE India, Indonesia, S Japan, Laos, Malaysia, Myanmar, Nepal, Papua New Guinea, Philippines, Thailand, Vietnam].

**2. *Lasianthus austrosinensis*** H. S. Lo, Bot. J. S. China 2: 4. 1993.

华南粗叶木 hua nan cu ye mu

Shrubs, 1–2 m tall; branches and branchlets densely appressed strigillose. Petiole 3–8 mm, densely strigillose; leaf

blade papery, ovate, 5–8 × 2.5–3 cm, glabrous adaxially, appressed strigillose on midrib and nerves abaxially, base obtuse or subrounded, apex shortly cuspidate; lateral veins ca. 5 pairs; nervules subparallel; nerves and nervules elevated abaxially; stipules generally persistent, triangular to broadly triangular, 1–1.5 mm, densely strigillose. Inflorescences glomerulate to subcapitate, sessile; bracts absent. Flowers sessile or subsessile. Calyx densely strigillose; hypanthium portion obconic, ca. 1 mm; limb deeply lobed; lobes 5, oblong to elliptic or oblanceolate, 3–3.5 mm, nerved, obtuse. Corolla ca. 5 mm, densely hirsute outside, villous in upper half inside; lobes 5, triangular. Fruit subglobose, 4–5 mm in diam., strigillose; pyrenes 5.

• Forests, shaded and wet places; 300–500 m. Guangdong, Guangxi, Hainan.

H. Zhu (Syst. & Geogr. Pl. 72: 85. 2002) noted that the relatively well-developed calyx lobes with evident venation are distinctive for this species; the calyx lobes are also distinctive in being widest near the middle rather than at the base as in most other *Lasianthus* species.

**3. *Lasianthus austroyunnanensis*** H. Zhu, Syst. & Geogr. Pl. 72: 96. 2002.

滇南粗叶木 dian nan cu ye mu

Shrubs, to 1 m tall; branchlets densely appressed hirsute. Petiole 5–8 mm, hirsute; leaf blade papery to membranous, ovate-elliptic, 4–6 × 2–3 cm, glabrous adaxially, appressed hirsute on midrib and nerves abaxially, base acute or obtuse, apex cuspidate-acuminate or acuminate; lateral veins 4 or 5 pairs; nervules subparallel; nerves and nervules elevated conspicuously abaxially; stipules ?persistent, triangular, minute, hirsute. Inflorescences glomerulate, sessile; bracts minute, hirsute. Flowers sessile. Calyx hirsute; hypanthium portion campanulate, ca. 1 mm; limb 1–1.5 mm, toothed; teeth 5. Corolla 8–10 mm, pubescent outside, villous inside. Fruit globose, 4–5 mm in diam., subglabrous; pyrenes 5.

- Forests, shaded and wet places; 1000–1300 m. Taiwan, Yunnan.

This species has been often misidentified as *Lasianthus microphyllus* Elmer. After examining type specimens of *L. microphyllus* from the Philippines (Elmer 13790, isotypes in A, CAS, E, K, L, MO), it is clear that the Chinese populations differ from *L. microphyllus* by having appressed-hirsute hairs on the branches, leaf midrib and nerves abaxially, and the outside of the calyx and corolla. The leaves are ovate-elliptic with a cuspidate-acuminate or acuminate apex. In contrast, *L. microphyllus* has subglabrous or glabrous branches, leaves, and flowers, and the leaves are ovate with a caudate apex. Therefore, the Chinese taxon represents a separate species. The name *L. microphyllus* has also been sometimes misapplied in Taiwan to plants of *L. micranthus*.

**4. *Lasianthus biermannii*** King ex J. D. Hooker, Fl. Brit. India 3: 190. 1880.

梗花粗叶木 geng hua cu ye mu

Shrubs, 2–5 m tall; branchlets sparsely pubescent to densely appressed pubescent to strigose, or subglabrous. Petiole 7–14 mm, pubescent to strigose; leaf blade membranous or papery, elliptic, elliptic-ovate, or elliptic-lanceolate, 8–20 × 3–5 cm, glabrous adaxially, sparsely pubescent to densely appressed pubescent on midrib, lateral veins, and nervules abaxially, base acute to obtuse or rounded, apex cuspidate-acuminate; lateral veins 5–7 pairs; nervules reticulate, slender and inconspicuous to parallel and conspicuously elevated abaxially; stipules triangular or lanceolate, 3–5 mm, pubescent to strigillose, apparently caducous. Inflorescences congested-cymose to subcapitate, densely strigillose, pedunculate; peduncles slender to robust, 5–15 mm; bracts linear, 2–10 mm. Flowers sessile or subsessile. Calyx purple when fresh, strigillose; hypanthium portion turbinate, 1–1.5 mm; limb 4–5 mm; lobes 4–6, narrowly lanceolate to oblanceolate, 2–4 mm. Corolla light purple when fresh, 7–8 mm, villous inside; tube 3–5 mm, glabrous outside; lobes 4–6, oblong-ovate, 3–4 mm, pilosulous outside. Fruit globose, 0.3–1.5 cm in diam., smooth or with ca. 5 ridges; pyrenes 5. Fl. Apr, Oct–Nov, fr. Jul.

Montane forests, shaded and wet places; 1000–2500 m. Guizhou, Hainan, Xizang, Yunnan [Bhutan, NE India, Myanmar].

The well-developed calyx lobes that are usually broadest near the apex are distinctive.

- 1a. Branches usually sparsely pubescent or subglabrous and leaf nerves abaxially sparsely pubescent; nervules reticulate, slender and inconspicuous; calyx lobes relatively narrow and short; peduncles slender, longer or shorter than petioles ..... 4a. subsp. *biermannii*
- 1b. Branches and leaf nerves abaxially densely appressed strigose; leaf nervules parallel and conspicuously elevated abaxially; calyx lobes relatively wide and long; peduncles robust and usually longer than petioles ..... 4b. subsp. *crassipedunculatus*

**4a. *Lasianthus biermannii*** subsp. *biermannii*

梗花粗叶木(原亚种) geng hua cu ye mu (yuan ya zhong)

Branches sparsely pubescent or subglabrous. Leaf blade with nerves abaxially sparsely pubescent; nervules reticulate, slender and inconspicuous. Peduncles slender, longer or shorter than petioles. Calyx lobes relatively narrow and short.

Montane forests, shaded and wet places; 1200–2500 m. Yunnan [Bhutan, NE India, Myanmar].

**4b. *Lasianthus biermannii*** subsp. *crassipedunculatus* C. Y. Wu & H. Zhu, Acta Phytotax. Sin. 32: 75. 1994.

粗梗粗叶木 cu geng cu ye mu

*Lasianthus esquirolii* H. Léveillé.

Branches densely appressed strigose. Leaf blade with nerves densely appressed strigose abaxially; nervules parallel and conspicuously elevated abaxially. Peduncles robust and usually longer than petioles. Calyx lobes relatively wide and long.

- Forests, shaded and wet places; 1000–1700 m. Guizhou, Hainan, Yunnan.

Rehder (J. Arnold Arbor. 16: 323. 1935) considered that *Henry 11148* from Yunnan province of China, cited by Hutchinson as *Lasianthus biermannii*, matched the type specimen of *L. esquirolii* (J. Esquirol 648) from Guizhou province of China, so he reduced *L. esquirolii* to a synonym of *L. biermannii*. However, Ferguson (Notes Roy. Bot. Gard. Edinburgh 32(1): 109. 1972) contended that the type of *L. esquirolii* did not sufficiently match the type of *L. biermannii* and again recognized *L. esquirolii* as a separate species. Many specimens from SE Yunnan and Hainan are closely related to *L. biermannii* but clearly differ from it and have been treated as a geographic subspecies of *L. biermannii*. When the type of *L. esquirolii* was checked, it was concluded that *L. esquirolii* is the same as *L. biermannii* subsp. *crassipedunculatus*.

**5. *Lasianthus biflorus*** (Blume) M. Gangopadhyay & Chakraborty, J. Econ. Taxon. Bot. 16: 338. 1992.

石核木 shi he mu

*Litosanthes biflora* Blume, Catalogus, 22. 1823; *Lasianthus gracilis* King & Gamble.

Shrubs, 1–2.5 m tall; branchlets terete, densely hirsute to pilosulous. Petiole 0.5–2 mm, hirsute to pilosulous; leaf blade thinly to thickly papery, subrhombic or elliptic-obovate, elliptic, or subovate, 1.5–3 cm × 7–15 mm, glabrous adaxially, hirtellous to pilosulous abaxially, base cuneate, margin flat, often undulate, apex acute, often mucronulate; midrib depressed adaxially, prominent abaxially, hirsute or pilosulous abaxially; lateral veins plane adaxially, prominent abaxially, 6–9 pairs, hirsute or pilosulous abaxially, extending to unite with margin; nervules obscure on both surfaces; stipules ± inconspicuous, narrowly triangular, 0.5–2 mm, densely pilosulous to hirtellous, at apex acute sometimes with 2–4 very small lateral projections or lobes. Inflorescence congested-cymose or with solitary flowers, pedunculate; peduncles 0.5–1.7 cm, sparsely hirsute to pilosulous; bracts inconspicuous, lanceolate to linear, 0.3–1.2 mm. Flowers pedicellate; pedicels 0.2–1 mm. Calyx glabrous to sparsely hirtellous; hypanthium portion campanulate, 1.2–1.5 mm; limb deeply 5-toothed; teeth triangular, ca. 0.5 mm. Corolla 2–4 mm, glabrous outside, villous in throat and on inside of lobes; lobes ovate, shorter than tube, rostriform-incurved at

apex. Fruit ovoid or depressed globose, 3–5 mm in diam., glabrous, verrucose, 4-grooved; pyrenes 4.

Forests, shaded and wet places; 600–700 m. Hainan, Taiwan, S Yunnan [Indonesia, Malaysia, Philippines, Thailand, Vietnam].

**6. *Lasianthus calycinus*** Dunn, Bull. Misc. Inform. Kew 1912: 367. 1912.

黄果粗叶木 huang guo cu ye mu

Shrubs, 1.5–3 m tall; branchlets appressed pubescent or strigillose to glabrescent. Petiole 8–10 mm, appressed pubescent or strigillose to glabrescent; leaf blade thickly papery, oblong-elliptic, 13–15 × 4–6 cm, glabrous adaxially, sparsely appressed pubescent to strigillose on nerves abaxially, base broadly cuneate or subrounded, apex acute to shortly acuminate; lateral veins 7–9 pairs, extending to unite with margin; nervules parallel; nerves and nervules conspicuous abaxially; stipules generally persistent, broadly triangular, ca. 2 mm, strigillose, acute. Inflorescences glomerulate to subcapitate, sessile, 4–6-flowered; bracts absent. Flowers subsessile. Calyx strigillose; hypanthium portion 1.5–2 mm; limb deeply lobed; lobes 5, linear-lanceolate to narrowly triangular, 2.5–5 mm, acute. Corolla 7–9 mm, strigillose outside; lobes 5, ovate. Fruit orange or red-orange, subglobose, 6–7 mm in diam., sparsely strigillose to glabrescent, with longitudinal elevated angles. Fl. Apr–May, fr. Sep–Oct, Dec.

- Forests, shaded and wet places; 600–700 m. Hainan.

H. Zhu (Syst. & Geogr. Pl. 72: 83. 2002) noted that this species is similar to and may even be conspecific with the poorly known species *Lasianthus latifolius* (Blume) Miquel of Borneo, Java, and Sumatra.

**7. *Lasianthus chevalieri*** Pitard in Lecomte, Fl. Indo-Chine 3: 384. 1924.

长萼粗叶木 chang e cu ye mu

*Lasianthus longisepalus* Geddes; *L. longisepalus* var. *jianfengensis* H. S. Lo.

Shrubs, to 2 m tall; branches and branchlets densely yellow villous. Petiole 1–1.5 cm, long, yellow villous; leaf blade subleathery, elliptic-oblong, 11–16 × 3.5–5.5 cm, glabrous adaxially, yellow villous abaxially, base cuneate, apex acuminate; lateral veins ca. 11 pairs, prominent abaxially; nervules parallel, prominent abaxially; stipules generally persistent, narrowly triangular, ca. 3 mm, spreading yellow villous. Inflorescences glomerulate, sessile; bracts inconspicuous. Flowers sessile. Calyx densely pilose; hypanthium portion obconic, 1.5–3 mm; limb with tubular portion 1.5–3 mm; lobes 5–7, linear, 9–14 mm. Corolla tube 12–13 mm; lobes 5–7, lanceolate, 7–8 mm, densely pilose. Fruit subglobose, 6–7 mm in diam., pilose; pyrenes 5–7.

Forests, shaded and wet places; 800–1500 m. Hainan [Thailand, Vietnam].

The sessile flowers with relatively long calyx lobes are quite distinctive.

**8. *Lasianthus chinensis*** (Champion ex Benth) Benth, Fl. Hongk. 160. 1861.

粗叶木 cu ye mu

*Mephitidia chinensis* Champion ex Benth, Hooker's J. Bot. Kew Gard. Misc. 4: 196. 1852; *Lasianthus dinhensis* Pierre ex Pitard; *M. odajimae* Masamune.

Shrubs, 1–4 m tall; branches and branchlets terete, densely pubescent or puberulent to strigillose. Petiole 0.5–1.5 cm, densely pubescent or puberulent to strigillose; leaf blade subleathery, oblong to elliptic, 11–25 × 2.5–7 cm, glabrous adaxially, thinly to densely pubescent or puberulent to strigillose abaxially, base acute or obtuse, margin plane or usually reflexed, apex acute or acuminate; lateral veins 9–15 pairs; nervules reticulate, slightly elevated abaxially; stipules generally persistent, triangular to narrowly triangular, 1.5–3 mm, densely pubescent or puberulent to strigillose. Inflorescences subcapitate to congested-cymose, sessile to subsessile; bracts reduced. Flowers sessile or subsessile. Calyx puberulent to strigillose; hypanthium portion globose to ellipsoid, 1.5–3 mm; limb 1.5–2.5 mm, lobed for 1/2–2/3; lobes 4–6, triangular, ovate, or orbicular, becoming reflexed. Corolla 10–15 mm, densely strigillose to sericeous outside; lobes 5 or 6, lanceolate. Fruit globose to depressed globose, 5–8 mm in diam., pubescent to strigillose, with 5 or 6 conspicuous longitudinal angles; pyrenes 5 or 6. Fl. May–Jun, fr. Sep–Oct.

Forests, shaded and wet places; below 100–900 m. Fujian, Guangdong, Guangxi, Hainan, Taiwan [Cambodia, Laos, Malaysia, Philippines, Thailand, Vietnam].

The relatively large flowers with the large globose to ellipsoid hypanthium (i.e., ovary) portion is distinctive; *Lasianthus verticillatus* is similar in these characters but can be distinguished by its truncate to denticulate calyx limb and smooth fruit. The calyx limb often enlarges as the fruit develops.

**9. *Lasianthus chrysonurus*** (Korthals) Miquel, Fl. Ned. Ind. 2: 322. 1857.

库兹粗叶木 ku zi cu ye mu

*Mephitidia chrysonura* Korthals, Ned. Kruidk. Arch. 2(2): 222. 1851; *Lasianthus hoensis* Pierre ex Pitard; *L. kurzii* J. D. Hooker; *L. kurzii* var. *howii* H. S. Lo.

Shrubs, to 3 m tall; branchlets appressed pubescent to densely velutinous. Petiole 5–10 mm, appressed pubescent to densely velutinous; leaf blade membranous, elliptic-oblong to elliptic-lanceolate, 12–20 × 3–5 cm, glabrous adaxially, appressed pubescent to puberulent abaxially, base cuneate to acute, apex acuminate; lateral veins 7–10 pairs; nervules parallel, ± inconspicuous; stipules deciduous, triangular or oblong-lanceolate, 3–8 mm, pubescent to densely velutinous, strigillose on margin. Inflorescences glomerulate to subcapitate, sessile; bracts persistent, outer bracts ovate, inner bracts lanceolate, all 1–5 mm, pubescent to densely strigillose, especially on margin. Flowers sessile or subsessile. Calyx densely strigillose; hypanthium portion campanulate, 1–1.5 mm; limb deeply lobed; lobes 4–6, triangular, 1.5–2 mm. Corolla 5–6 mm, puberulent outside on upper part, pubescent inside in throat. Fruit blue-black, subglobose, 4–6 mm in diam., pubescent to strigillose or puberulent; pyrenes 5 or 6.

Forests, shaded and wet places; 500–1200 m. S Yunnan [Cam-

bodia, India, Indonesia (Java), Laos, Myanmar, Papua New Guinea, Thailand, Vietnam].

H. Zhu (Syst. & Geogr. Pl. 72: 80. 2002) noted that this species is very similar to *Lasianthus obscurus*.

**10. *Lasianthus chunii*** H. S. Lo, Bot. J. S. China 2: 10. 1993.

焕镛粗叶木 huan yong cu ye mu

Shrubs, 1–3 m tall; branchlets dark brown, densely hirsute or strigose. Petiole 0.5–1 cm, densely hirsute to strigillose; leaf blade subleathery or thickly papery, lanceolate or oblong-lanceolate, 8–15 × 2–5.5 cm, glabrous adaxially, hirsute or strigillose on midrib, nerves, and nervules abaxially, base cuneate or obtuse to rounded, apex acuminate; lateral veins 7 or 8 pairs; nervules subparallel; veins and nervules conspicuously elevated abaxially; stipules 1–1.5 mm, densely hirsute to strigillose, apparently caducous. Inflorescence congested-cymose, shortly pedunculate, 2–4-flowered, densely strigillose; peduncle 1–2 mm; bracts narrowly triangular, 1–2 mm. Flowers sessile to pedicellate; pedicels to 1 mm. Calyx strigillose; hypanthium portion campanulate, 1–1.5 mm; limb ca. 2 mm; lobes 6, subtriangular, ca. 1 mm. Corolla ca. 1 cm, hirsute or strigillose outside, villous in upper half inside; lobes 6, lanceolate. Fruit depressed globose, ca. 5 mm in diam., hirsute or strigillose, with 5 or 6 longitudinal elevated angles or ridges; pyrenes 5 or 6. Fl. Apr, fr. Jun–Jul, Sep.

• Forests, shaded and wet places. SE Fujian, Guangdong, SE Guangxi, S Jiangxi.

**11. *Lasianthus curtisii*** King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73: 128. 1904.

广东粗叶木 guang dong cu ye mu

*Lasianthus condorensis* Pierre ex Pitard; *L. formosensis* Matsumura var. *hirsutus* Matsumura; *L. kwangtungensis* Merrill.

Shrubs, 1–2 m tall; branches and branchlets densely spreading villous. Petiole 4–8 mm, densely villous; leaf blade papery or subleathery, ovate-lanceolate or elliptic-lanceolate, 5–9 × 2–3 cm, glabrous adaxially, densely soft villous abaxially, base cuneate or obtuse, apex cuspidate-acuminate; lateral veins 4–6 pairs; nervules subparallel; stipules generally persistent, narrowly triangular, 1–1.5 mm, densely strigose. Inflorescences glomerulate to subcapitate, sessile; bracts absent. Flowers sessile to subsessile. Calyx densely villous to hirsute; hypanthium portion obconic, 1–1.5 mm; limb divided nearly to base; lobes 5, lanceolate to narrowly triangular, 2–5 mm, acuminate. Corolla 7–8 mm, outside hispid, inside villous; lobes 5. Fruit ovoid-globose, 4–5 mm in diam., hirsute to villous; pyrenes 5. Fl. Aug–Sep, fr. Jun–Dec.

Forests, shaded and wet places; 300–900 m. Fujian, Guangdong, Guangxi, Hainan, Taiwan [Indonesia (Sumatra), Japan (Kyushu, Ryukyu Islands), Malaysia, Thailand, Vietnam].

**12. *Lasianthus filipes*** Chun ex H. S. Lo, Bot. J. S. China 2: 8. 1993.

长梗粗叶木 chang geng cu ye mu

Shrubs, 1–2 m tall; branchlets slender, densely strigose. Petiole 1–5 mm, densely hirsute or strigillose; leaf blade pa-

pery, ovate or ovate-oblong, 5–8 × 2–3 cm, glabrous adaxially, appressed pubescent to strigillose on midrib, veins, and nervules abaxially, base obtuse, rounded, or rarely subcordate, apex shortly acuminate or cuspidate-acuminate; lateral veins 4 or 5 pairs; nervules subparallel, conspicuous abaxially; stipules minute, densely appressed hirsute or strigose, apparently caducous. Inflorescence congested-cymose or subcapitate, pedunculate, few flowered; peduncles slender, 1–3 cm, densely hirsute or strigose; bracts subulate, 1–2.5 mm, hirsute or strigose. Flowers sessile to shortly pedicellate. Calyx hirsute or strigillose; hypanthium portion campanulate, ca. 1 mm; limb 1.5–2 mm; lobes 5, subulate, 1–1.5 mm. Corolla ca. 5 mm; tube puberulent outside, densely villous in upper half inside; lobes 5, ovate, ca. 1.5 mm, villous inside. Fruit globose, 7–8 mm in diam., subglabrous; pyrenes 5. Fl. Apr.

Forests, shaded and wet places; 500–1500 m. Fujian, Guangdong, Guangxi, Hainan, Yunnan [N Vietnam].

**13. *Lasianthus fordii*** Hance, J. Bot. 23: 324. 1885.

罗浮粗叶木 luo fu cu ye mu

*Lasianthus kamputensis* Pierre ex Pitard; *L. tashiroi* Matsumura; *L. zambalensis* Elmer.

Shrubs, 1–2 m tall; branches and branchlets glabrous to thinly appressed pubescent or strigose. Petiole 0.4–1 cm, subglabrous to hirsute or strigillose; leaf blade subleathery or papery, ovate-oblong, 6–10 × 2–5 cm, glabrous adaxially, thinly appressed strigillose or subglabrous abaxially, base acute or obtuse, apex acuminate or cuspidate-acuminate; lateral veins 4–6 pairs; nervules subparallel, elevated abaxially; stipules generally persistent, triangular to narrowly triangular, 0.5–1.2 mm, strigillose. Inflorescences glomerulate, sessile; bracts absent. Flowers sessile. Calyx sparsely to densely strigillose; hypanthium portion campanulate to obconic, ca. 1 mm; limb 1–1.5 mm, shallowly toothed; teeth 5, triangular. Corolla 6–10 mm, glabrous to puberulent outside, villous inside; lobes 5. Fruit globose or subglobose, 5–6 mm in diam., glabrous to strigillose; pyrenes 5 or 6.

Forests, shaded and wet places; 200–1000 m. Fujian, Guangdong, Guangxi, Hainan, Taiwan, Yunnan [Cambodia, Indonesia (Java), Japan (Kyushu, Ryukyu Islands, Yakushima), Papua New Guinea, Philippines, Thailand, Vietnam].

*Lasianthus fordii* var. *trichocladus* H. S. Lo (Bot. J. S. China 2: 7. 1993) was described from SE China (Guangdong, Guangxi, and Hainan) but could not be treated here because no material was seen by the present authors.

**14. *Lasianthus formosensis*** Matsumura, Bot. Mag. (Tokyo) 15: 17. 1901.

台湾粗叶木 tai wan cu ye mu

*Lasianthus kwangsiensis* Merrill ex H. L. Li; *L. tashiroi* Matsumura var. *pubescens* Matsumura; *L. tenuicaudatus* Merrill.

Shrubs, 1–2 m tall; branches and branchlets densely villous or villosulous. Petiole 5–8 mm, villous to villosulous; leaf blade papery or subleathery, oblong or ovate-elliptic, 7–12 × 2.5–5 cm, glabrous adaxially, villous or villosulous at least on

veins abaxially, base acute or obtuse, apex acuminate or cuspidate-acuminate; lateral veins 6 or 7 pairs; nervules subparallel, slightly elevated abaxially; stipules generally persistent, triangular, ca. 2 mm, villous to villosulous. Inflorescences glomerulate to congested-cymose, sessile to shortly pedunculate; bracts absent. Flowers sessile. Calyx pilosulous to villosulous; hypanthium obconic to campanulate, ca. 1 mm; limb 3–4 mm, deeply lobed; lobes 5, linear-lanceolate. Corolla 6–8 mm, villous outside, tomentose inside; lobes 5, oblong-lanceolate. Fruit ovoid-globose, ca. 5 mm in diam., subglabrous; pyrenes 5. Fl. Oct–Dec, fr. Apr.

Forests, shaded and wet places; 500–1000 m. Guangdong, Guangxi, Hainan, Taiwan, Yunnan [Japan (Kyushu, Ryukyu Islands, Yakushima), Thailand, Vietnam].

**15. *Lasianthus henryi*** Hutchinson in Sargent, Pl. Wilson. 3: 401. 1916.

西南粗叶木 xi nan cu ye mu

*Lasianthus appressihirtus* Simizu; *L. appressihirtus* var. *maximus* Simizu ex T. S. Liu & J. M. Chao; *L. inconspicuus* J. D. Hooker var. *hirtus* Hutchinson.

Shrubs, 1–1.5 m tall; branches and branchlets densely appressed pubescent or strigillose. Petiole 3–8 mm, appressed strigillose; leaf blade subleathery or papery, oblong-lanceolate, 6–12 × 1.5–3.5 cm, glabrous adaxially, appressed pubescent abaxially on nerves or strigillose on veins, base acute or cuneate, apex cuspidate-acuminate; lateral veins 7 or 8 pairs; nervules subparallel; nerves and nervules conspicuously elevated abaxially; stipules generally persistent, triangular, 0.5–1.2 mm, densely strigillose. Inflorescences glomerulate to subcapitate, sessile or subsessile or very shortly pedunculate; bracts minute, strigillose. Flowers sessile. Calyx densely strigillose; hypanthium portion campanulate to obconic, ca. 1 mm; limb 1–1.5 mm, lobed for 1/3–3/4; lobes 5, linear-lanceolate. Corolla ca. 8 mm, glabrous or strigillose on lobes outside, villous inside; lobes 5. Fruit globose, ca. 5 mm in diam., strigillose; pyrenes 5. Fl. Jun, fr. Jul–Oct.

• Forests, shaded and wet places; 200–1900 m. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Sichuan, Taiwan, E Xizang, Yunnan.

**16. *Lasianthus hirsutus*** (Roxburgh) Merrill, J. Arnold Arbor. 33: 229. 1952.

鸡屎树 ji shi shu

*Triosteum hirsutum* Roxburgh, Fl. Ind. 2: 180. 1824.

Shrubs, 1–2 m tall; branchlets stiffly spreading rusty hirsute to glabrescent. Petiole 10–15 mm, hirsute; leaf blade subleathery or leathery, oblong or oblanceolate-oblong, 13–25 × 5–7.5 cm, glabrous adaxially, densely hirtellous or hirsute to strigose abaxially, base acute to obtuse, apex shortly acuminate; lateral veins 7–10 pairs; nervules subparallel, elevated abaxially; stipules lanceolate to deltoid, 8–10 mm, hirsute, generally persistent at least on apical nodes. Inflorescences glomerulate, sessile, hirsute; bracts leaflike, numerous, persistent, outer ones ovate-lanceolate, 2–3 cm, with distinct nerves, inner ones linear, much smaller. Flowers sessile. Calyx densely hirsute; hypanthium portion obconical, ca. 1 mm; limb 5-lobed; lobes linear-

lanceolate, ca. 2.5 mm. Corolla 11–15 mm; tube 8–12 mm, outside glabrous in lower half and hirsute in upper half, glabrous inside; lobes 5, ovate, ca. 3 mm. Fruit ovoid-globose, 4–5 mm in diam., hirsute to glabrescent, with ca. 5 rounded ridges; pyrenes 5. Fr. Nov.

Forests, shaded and wet places; 100–1500 m. Guangdong, Guangxi, Hainan, Taiwan [Bangladesh, India (including Andaman and Nicobar Islands), Indonesia, Japan (Ryukyu Islands), Malaysia, Myanmar, Papua New Guinea, Philippines, Thailand, Vietnam].

*Lasianthus hirsutus* is a widely distributed species. It was mistakenly called "*L. cyanocarpus*" by most authors until Merrill (loc. cit.) showed the correct application of the name. *Lasianthus cyanocarpus* has relatively smaller leaves with cordate and slightly oblique bases and usually fewer and relatively smaller bracts; *L. hirsutus* differs from it in relatively larger leaves with cuneate, slightly unequal bases, relatively longer petioles, conspicuous triangular stipules, more numerous bracts with the outer ones ovate-oblong and leaflike and the inner ones gradually narrower and smaller, as well as usually long rusty hirsute hairs on most parts of the plants.

**17. *Lasianthus hispidulus*** (Drake) Pitard in Lecomte, Fl. Indo-Chine 3: 393. 1924.

文山粗叶木 wen shan cu ye mu

*Mephitidia hispidula* Drake, J. Bot. (Morot) 9: 239. 1895; *Lasianthus brevidens* Craib; *L. bunzanensis* Simizu.

Shrubs, 1–1.5 m tall; branches and branchlets densely villous or strigose. Petiole 4–7 mm, densely hirsute or strigose to strigillose; leaf blade thinly leathery to papery, elliptic or ovate-oblong, 7–10 × 3–5 cm, glabrous adaxially, densely villous abaxially, base acute or obtuse, apex cuspidate-acuminate or acuminate; lateral veins 4–6 pairs; nervules subparallel; midrib and veins elevated abaxially, nervules slightly elevated abaxially, strigose to strigillose; stipules generally persistent, 0.5–1 mm, densely hirsute or strigillose. Inflorescences glomerulate, sessile; bracts absent. Flowers sessile. Calyx strigillose; hypanthium campanulate, 1–1.5 mm; limb 1–1.5 mm, shortly toothed; teeth 5, broadly triangular. Corolla 6–7 mm, pilose outside, villous inside; lobes 5. Fruit globose, 3–6 mm in diam., strigillose; pyrenes 5.

Forests, shaded and wet places; 300–600 m. Guangdong, Guangxi, Hainan, Taiwan, Yunnan [Indonesia (Sumatra), Japan (Ryukyu Islands), Malaysia (Borneo), Thailand, Vietnam].

**18. *Lasianthus hookeri*** C. B. Clarke ex J. D. Hooker, Fl. Brit. India 3: 184. 1880.

虎克粗叶木 hu ke cu ye mu

Shrubs, up to 5 m tall; branches and branchlets densely appressed pubescent to sericeous. Petiole 5–10 mm, appressed puberulent to strigose or sericeous; leaf blade papery or subleathery, oblong, 12–24 × 3–6 cm, glabrous adaxially, puberulent or ciliate on nerves and margins abaxially, base obtuse or cuneate, apex caudate-acuminate; lateral veins 6–8 pairs, outermost pair extending to tip of leaf; nervules subparallel, conspicuously elevated abaxially; stipules generally persistent, triangular to broadly triangular, 2–3 mm, appressed puberulent to strigose or sericeous. Inflorescences glomerulate, sessile; bracts absent or few, linear, 3–4 mm. Flowers sessile. Calyx subgla-

brous to puberulent; hypanthium campanulate, 1.5–2 mm; limb lobed for 1/2–3/4; lobes 4–6, lanceolate to narrowly triangular, 1–2 mm. Corolla 6–7 mm, puberulent outside; tube 4–5 mm; lobes 4–6, ovate-lanceolate, ca. 2 mm. Fruit subglobose, 4–5 mm in diam., glabrous or puberulent, smooth; pyrenes 5.

Forests, shaded and wet places; 300–1500 m. Guangxi, Guizhou, Xizang, Yunnan [NE India, Myanmar, Thailand, Vietnam].

- 1a. Leaf margins densely ciliate; bracts subulate; calyx limb plus hypanthium ca. 2 mm, with minute subulate teeth ..... 18a. var. *dunnianus*  
 1b. Leaf margins sparsely ciliate; bracts absent; calyx limb plus hypanthium ca. 3 mm, with lanceolate, ca. 1 mm lobes ..... 18b. var. *hookeri*

**18a. *Lasianthus hookeri* var. *dunnianus*** (H. Léveillé) H. Zhu, Acta Phytotax. Sin. 32: 71. 1994 [“*dunniana*”].

睫毛虎克粗叶木 jie mao hu ke cu ye mu

*Lasianthus dunnianus* H. Léveillé, Repert. Spec. Nov. Regni Veg. 11: 64. 1912 [“*dunniana*”].

Leaf blade with margin densely ciliate. Bracts subulate. Calyx limb plus hypanthium ca. 2 mm, with minute subulate teeth.

Forests, shaded and wet places; 300–1500 m. Guangxi, Guizhou, Yunnan [N Myanmar].

**18b. *Lasianthus hookeri* var. *hookeri***

虎克粗叶木(原变种) hu ke cu ye mu (yuan bian zhong)

Leaf blade with margin sparsely ciliate. Bracts absent. Calyx limb plus hypanthium ca. 3 mm; lobes lanceolate, ca. 1 mm.

Forests, shaded and wet places; 600–1500 m. Xizang, Yunnan [NE India, Myanmar, Thailand, Vietnam].

**19. *Lasianthus inodorus*** Blume, Bijdr. 998. 1826–1827.

革叶粗叶木 ge ye cu ye mu

*Lasianthus poilanei* Pitard; *L. tubiferus* J. D. Hooker.

Shrubs, 2–3 m tall; branches and branchlets glabrous or thinly puberulent. Petiole 6–10 mm, glabrous or sparsely puberulent; leaf blade leathery, elliptic to elliptic-lanceolate, 10–20 × 2.5–6 cm, glabrous adaxially, glabrous or sparsely puberulent abaxially, base acuminate, apex acuminate; lateral veins 6 or 7 pairs; nervules parallel; nerves and nervules conspicuous abaxially; stipules persistent, triangular or ovate-lanceolate, 3–5 mm, glabrous, leathery. Inflorescences sessile, glomerulate; bracts persistent, orbicular or ovate-orbicular, 3–6 mm, thickly leathery, glabrous or pubescent. Flowers sessile. Calyx puberulent; hypanthium portion ca. 1 mm; limb 5-lobed; lobes ovate-lanceolate. Corolla ca. 10 mm, puberulent outside, villous inside. Fruit red, ovoid, ca. 10 mm, glabrous; pyrenes 5.

Montane forests, shaded and wet places; 1000–1800 m. S Yunnan [E Bangladesh, Cambodia, NE India, Indonesia (Java, Sumatra), Thailand, Vietnam].

**20. *Lasianthus japonicus*** Miquel, Ann. Mus. Bot. Lugduno-Batavi 3: 110. 1867.

日本粗叶木 ri ben cu ye mu

Shrubs, 1–2 m tall; branches and branchlets glabrous or subglabrous to sparsely strigose on young branches. Petiole 3–10 mm, sparsely strigillose to strigose or subglabrous; leaf blade leathery or papery, lanceolate, lanceolate-oblong, or oblong, 9–15 × 2–3.5 cm, glabrous adaxially, glabrous to strigose or hirtellous abaxially, especially on lateral veins and nervules, base acute to obtuse, apex cuspidate or cuspidate-acuminate to long caudate; lateral veins 5–7 pairs or numerous; nervules reticulate; stipules generally persistent, triangular, 1–3 mm, glabrous to minutely hirsute to strigillose. Inflorescences congested-cymose, pedunculate to subsessile, densely strigillose; peduncle 1–2 mm; bracts 0.2–1 mm. Flowers sessile or subsessile. Calyx strigillose to glabrescent; hypanthium portion campanulate, 1–1.5 mm; limb 1–2 mm, 4- or 5-dentate; teeth short to well developed, linear. Corolla 13–14 mm at anthesis, glabrous outside or sometimes puberulent on lobes, villous inside; tube 9–10 mm; lobes 4 or 5, spatulate, 4–4.5 mm. Fruit globose, 5–6 mm in diam., glabrous; pyrenes 4 or 5. Fl. Apr–May, fr. Jun–Oct.

Forests, shaded and wet places; 200–2300 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hubei, Hunan, Jiangxi, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [NE India, S Japan (Kyushu, Ryukyu Islands, Shikoku), Laos, N Vietnam].

This species is commonly collected in China. The leaf margin is often finely irregular, not crisped but actually undulate parallel to the looping tertiary venation that is near it. The leaves generally flush in a characteristic fashion, elongating but remaining rolled up and narrow, and are covered with notable sericeous pubescence on the exposed lower surfaces of the midrib and principal veins. This pubescence is often deciduous, leaving the mature lower leaf surface glabrous.

*Lasianthus japonicus* is a widely distributed species from E Asia to the Himalaya. *Lasianthus japonicus* subsp. *japonicus* occurs in SE China to Japan, below 1800 m, and basically in the Sino-Japanese floristic region delineated by C. Y. Wu (Bull. Univ. Mus. Univ. Tokyo 37: 1–9. 1998). *Lasianthus japonicus* subsp. *longicaudus* occurs in SW China and NE India in the Himalaya, at 1000–2300 m, i.e., in the Sino-Himalayan floristic region of Wu. They are a typical vicariant pair of subspecies. It may be surprising that *L. lucidus* var. *caudisepalus* from Assam, NE India, is found to be conspecific with *L. japonicus* subsp. *japonicus*. However, the geological history of E Asia gives an explanation. The formation of the vicarious distribution patterns of the Sino-Himalayan and Sino-Japanese regions is supposed to be related to the uplift of Himalaya in the Tertiary. *Lasianthus japonicus* subsp. *longicaudus* could have differentiated with the uplift of Himalaya becoming an altitudinal vicariant taxon of *L. japonicus*.

- 1a. Leaves usually long caudate at apex, lateral veins numerous, slender, very similar to nervules or subparallel secondary nerves; calyx and corolla 4-merous; calyx teeth reduced, limb almost truncate at apex ..... 20b. subsp. *longicaudus*  
 1b. Leaves cuspidate or cuspidate-acuminate at apex, lateral veins 5–7 pairs, ascending at an oblique angle, conspicuously

different from reticulate nervules;  
calyx and corolla 4-merous or  
usually 5-merous; calyx with  
well-developed triangular or  
lanceolate teeth ..... 20a. subsp. *japonicus*

**20a. *Lasianthus japonicus* subsp. *japonicus***

日本粗叶木(原亚种) ri ben cu ye mu (yuan ya zhong)

*Lasianthus caudatifolius* Merrill; *L. hartii* Franchet; *L. japonicus* var. *satsumensis* (Matsumura) Makino; *L. lancilimbus* Merrill; *L. lucidus* Blume var. *caudisepalus* Deb & M. Gangopadhyay; *L. satsumensis* Matsumura.

Leaf blade cuspidate or cuspidate-acuminate at apex; lateral veins 5–7 pairs, ascending at an oblique angle, conspicuously different from reticulate nervules. Calyx 4- or usually 5-lobed, with triangular or lanceolate teeth. Corolla 4- or usually 5-lobed.

Forests, shaded and wet places; 200–1800 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hubei, Hunan, Jiangxi, Sichuan, Taiwan, Yunnan, Zhejiang [NE India, S Japan (Kyushu, Ryukyu Islands, Shikoku)].

Two varieties are recognized within *Lasianthus japonicus* subsp. *japonicus*; their morphological characters and geographic distribution are presented below.

*Lasianthus japonicus* var. *japonicus*: Leaf blade lanceolate, less than 3.5 cm wide. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hubei, Hunan, Jiangxi, Sichuan, Taiwan, Zhejiang [NE India, S Japan (Kyushu, Ryukyu Islands, Shikoku)].

*Lasianthus japonicus* var. *latifolius* H. Zhu (Acta Phytotax. Sin. 32: 79. 1994; 宽叶日本粗叶木 kuan ye ri ben cu ye mu): Leaf blade oblong-lanceolate, more than 3.5 cm wide. Guangxi, Guizhou, Sichuan, Yunnan.

**20b. *Lasianthus japonicus* subsp. *longicaudus* (J. D. Hooker) C. Y. Wu & H. Zhu, Acta Phytotax. Sin. 32: 80. 1994.**

云广粗叶木 yun guang cu ye mu

*Lasianthus longicaudus* J. D. Hooker, Fl. Brit. India 3: 190. 1880 [“*longicauda*”]; *L. pseudojaponicus* Masamune.

Leaf blade usually long caudate at apex; lateral veins numerous, slender, very similar to nervules or subparallel secondary nerves. Calyx 4-lobed, almost truncate at apex. Corolla 4-lobed.

Montane forests, shaded and wet places; 1000–2300 m. Guangxi, Guizhou, Sichuan, Xizang, Yunnan [NE India, Laos, N Vietnam].

**21. *Lasianthus lancifolius* J. D. Hooker, Fl. Brit. India 3: 187. 1880.**

美脉粗叶木 mei mai cu ye mu

Shrubs, 1.5–3 m tall; branches and branchlets puberulent. Petiole 5–10 mm, appressed pubescent; leaf blade papery, lanceolate to elliptic-lanceolate, 13–20 × 2.5–4 cm, glabrous adaxially, puberulent on nerves and nervules as well as margin abaxially, base acute to obtuse, apex long acuminate; lateral veins ca. 9 pairs, faint adaxially; nervules subreticulate, forked, very slender; stipules generally persistent, triangular, 2–3 mm, pu-

bescent. Inflorescences glomerulate, sessile; bracts absent. Flowers sessile. Calyx puberulent; hypanthium portion campanulate, 1–1.5 mm; limb 1–1.5 mm; teeth subulate. Corolla 12–13 mm, puberulent outside, pubescent inside at upper half; lobes 5, ovate, ca. 2 mm. Fruit globose, 4–5 mm in diam., glabrous or sparsely puberulent, smooth; pyrenes 5.

Forests, shaded and wet places; 500–1700 m. Guangdong, Guangxi, Hainan, Yunnan [Bangladesh, Bhutan, NE India, NE Thailand, N Vietnam].

**22. *Lasianthus linearisepalus* C. Y. Wu & H. Zhu, Acta Phytotax. Sin. 32: 61. 1994.**

线萼粗叶木 xian e cu ye mu

Shrubs, ca. 1 m tall; branchlets hirsute to subglabrous. Petiole ca. 5 mm, sparsely hirsute; leaf blade papery, oblong, 7–11 × 2.5–3 cm, glabrous adaxially, hirsute on nerves abaxially, base unequally cuneate, apex caudate; lateral veins 5 or 6 pairs; nervules subparallel; nerves and nervules elevated conspicuously abaxially; stipules ca. 1 mm, hirsute. Inflorescences glomerulate, sessile, 1–3-flowered; bracts subulate, 2–3 mm, hirsute. Flowers sessile. Calyx hirsute; lobes 5 or 6, linear, unequal, longest to 8 mm. Corolla strigose-villous outside. Fruit globose, sparsely hirsute; pyrenes 5.

• Montane forests, shaded and wet places; 1800–2100 m. SW Yunnan.

**23. *Lasianthus lucidus* Blume, Bijdr. 997. 1826–1827.**

无苞粗叶木 wu bao cu ye mu

Shrubs, 1–1.5 m tall; branches and branchlets glabrous or sparsely strigose on very young parts. Petiole 2.5–8 mm, strigillose or usually strigose; leaf blade membranous or subleathery, ovate, elliptic, or ovate-elliptic, 4–9 × 1.5–3 cm, glabrous adaxially, sparsely strigose or hirsute on nerves and nervules abaxially, base cuneate to obtuse, apex acuminate or cuspidate-acuminate; lateral veins 3–6 pairs, elevated abaxially; nervules parallel, conspicuous abaxially; stipules generally persistent, triangular, 1–1.5 mm, strigose. Inflorescences glomerulate to subcapitate, sessile; bracts absent. Flowers sessile or subsessile. Calyx with hypanthium portion obconic to widely campanulate, 1–1.5 mm, glabrescent; limb deeply lobed; lobes 5, narrowly triangular, 2–3 mm, usually somewhat unequal on an individual flower, strigose. Corolla 8–12 mm, glabrous or strigillose outside, villous at throat and on lobes inside; lobes 5, triangular, 2–2.5 mm. Fruit globose or ovoid, 4–5 mm in diam., glabrous; pyrenes 5.

Montane forests, shaded and wet places; 900–2400 m. Hainan, Yunnan [Bangladesh, NE India, Indonesia, Myanmar, Philippines, Thailand, Vietnam].

- 1a. Leaves elliptic, with lateral veins  
5 or 6 pairs ..... 23a. var. *inconspicuus*  
1b. Leaves ovate or ovate-elliptic, with  
lateral veins 3 or 4 pairs ..... 23b. var. *lucidus*

**23a. *Lasianthus lucidus* var. *inconspicuus* (J. D. Hooker) H. Zhu, Acta Bot. Yunnan. 20: 154. 1998.**

椭圆叶无苞粗叶木 tuo yuan ye wu bao cu ye mu

*Lasianthus inconspicuus* J. D. Hooker, Fl. Brit. India 3: 187. 1880.

Leaves elliptic; lateral veins 5 or 6 pairs.

Montane forests, shaded and wet places; 900–1800 m. Yunnan [Bangladesh, NE India, N Thailand].

**23b. *Lasianthus lucidus* var. *lucidus***

无苞粗叶木(原变种) wu bao cu ye mu (yuan bian zhong)

Leaves ovate or ovate-elliptic; lateral veins 3 or 4 pairs.

Montane forests, shaded and wet places; 1200–2400 m. Hainan, Yunnan [NE India, Indonesia, Myanmar, Philippines, Thailand, Vietnam].

**24. *Lasianthus micranthus* J. D. Hooker, Fl. Brit. India 3: 190. 1880.**

小花粗叶木 xiao hua cu ye mu

*Lasianthus balansae* (Drake) Pitard; *L. microstachys* Hayata; *Mephitidia balansae* Drake.

Shrubs, 1–2 m tall; branches and branchlets slender, sparsely puberulent to glabrous, smooth. Petiole 4–9 mm, hirsute or strigillose; leaf blade papery or subleathery, ovate, ovate-oblong, or oblong-lanceolate, 5–10 × 2.5–3.5 cm, glabrous adaxially, sparsely to densely hirsute or strigillose to strigose on midrib and nerves abaxially, base obtuse or rounded to subacute, apex acute or acuminate; lateral veins 5 or 6 pairs; nervules parallel or subparallel; stipules triangular or lanceolate, 1–1.5 mm, densely strigillose. Inflorescences congested-cymose to capitate, pedunculate, densely strigillose; peduncles 1.5–5 mm, slender; bract reduced or linear and up to 2 mm; bracteoles minute. Flowers sessile. Calyx densely strigillose or villous to glabrescent; hypanthium portion campanulate, ca. 1 mm; limb 1–1.5 mm; teeth 5, subulate or triangular. Corolla 5–6.5 mm, glabrous to puberulent outside, villous inside; tube 3–6 mm; lobes 5, spatulate, 2–2.5 mm. Fruit globose to depressed globose, ca. 5 mm in diam., glabrous, smooth or with ca. 5 low ridges; pyrenes 5. Fl. Aug–Nov, fr. Sep–Oct.

Forests, shaded and wet places; 100–1800 m. Fujian, Guangdong, Guangxi, Hainan, Taiwan, Xizang, Yunnan, Zhejiang [NE India, Thailand, N Vietnam].

The glabrous stems with strigillose rings at the nodes and the narrowly triangular, rather well-developed calyx lobes are distinctive.

**25. *Lasianthus obscurus* (Blume ex Candolle) Miquel, Fl. Ned. Ind. 2: 317. 1857.**

林生粗叶木 lin sheng cu ye mu

*Mephitidia obscura* Blume ex Candolle, Prodr. 4: 453. 1830; *Lasianthus kurzii* J. D. Hooker var. *fulvus* C. Y. Wu & H. Zhu; *L. kurzii* var. *sylvicola* H. S. Lo.

Shrubs, to 3 m tall; branchlets spreading tomentose or densely pilosulous. Petiole 5–10 mm, spreading tomentose or pilosulous to villous; leaf blade membranous, elliptic-oblong to oblong, 12–20 × 3–5 cm, glabrous adaxially, spreading tomentose or villous abaxially, base cuneate to acute, apex acuminate; lateral veins 7–10 pairs; nervules parallel, distinct on both sur-

faces; stipules generally persistent, triangular or oblong-lanceolate, 4–8 mm, tomentose or pilosulous to strigillose. Inflorescences glomerulate or subcapitate, sessile; bracts persistent, outer bracts ovate, inner bracts lanceolate, all 1–5 mm, tomentose or pilosulous to villous. Flowers sessile or subsessile. Calyx densely tomentose or strigose; hypanthium portion campanulate, 1–1.5 mm; limb deeply lobed; lobes 4–6, triangular, ca. 2 mm. Corolla 5–6 mm, puberulent outside on upper part, pubescent inside at throat. Fruit subglobose, 4–6 mm in diam., tomentose; pyrenes 5 or 6.

Forests, shaded and wet places; 300–1200 m. Hainan, Yunnan [India (S Andaman Islands), Indonesia (Java, Sumatra), Myanmar, Thailand, Vietnam].

H. Zhu (Syst. & Geogr. Pl. 72: 80. 2002) noted that this species is very similar to *Lasianthus chrysoneurus*.

**26. *Lasianthus rhinocerotis* Blume, Bijdr. 996. 1826–1827 [“*rhinozerotis*”].**

黄毛粗叶木 huang mao cu ye mu

Shrubs, 1–3 m tall; branches and branchlets densely villous. Petiole 5–10 mm, densely brown villous; leaf blade leathery, oblong-lanceolate or lanceolate, 15–21 × 4–7 cm, glabrous adaxially, densely villous abaxially, base broadly cuneate to truncate, subrounded, rounded, or slightly cordate, apex caudate-acuminate; lateral veins 7–12 pairs; nervules parallel to subreticulate; veins and nervules elevated conspicuously abaxially; stipules generally persistent, triangular, 2.5–4 mm. Inflorescences congested-cymose to subcapitate, shortly pedunculate, densely villous to strigose or pilose; peduncles 3–10[–25] mm; bracts numerous, narrowly triangular, linear, or filiform, 6–12 mm, densely brown villous. Flowers sessile. Calyx densely strigose to pilose; hypanthium portion 1.5–2 mm; limb ca. 4 mm, usually 6-lobed; lobes linear-lanceolate, 1.5–3 mm. Corolla ca. 7 mm, densely strigose to pilose outside; tube ca. 4 mm; lobes 5, oblong, ca. 3 mm. Fruit subglobose or obovoid, ca. 4 mm in diam., strigillose or subglabrous, slightly longitudinally angled, crowned with calyx lobes; pyrenes 4 or 5. Fl. Apr, May.

Forests, shaded and wet places; 300–1600 m. Guangxi, Hainan, Yunnan [Indonesia (Java, Sumatra), Malaysia, Thailand, N Vietnam].

*Lasianthus rhinocerotis* subsp. *rhinocerotis* occurs in Indonesia (Java, Sumatra), Malaysia, and Thailand. The description is as follows: young branches and leaf abaxially densely hairy; leaf blade leathery, base rounded or slightly cordate, lateral veins 9–12 pairs, nervules densely anastomosing, parallel, stipules triangular, ca. 3 mm; bracts slender, filiform.

- 1a. Leaf bases broadly cuneate to truncate or subrounded; stipules ± inconspicuous; bracts relatively thick, linear to narrowly triangular; young branches and leaf abaxially densely hairy; leaf blade papery to leathery with 8–12 pairs of lateral veins and with densely anastomosing, parallel nervules ..... 26a. subsp. *pedunculatus*
- 1b. Leaf bases rounded or slightly cordate; stipules triangular, ca. 3 mm; bracts slender, filiform; young branches and leaf

abaxially sparsely hairy; leaf blade papery with 7 or 8 pairs of lateral veins and with loosely anastomosing, subreticulate nervules ..... 26b. subsp. *xishuangbannaensis*

**26a. *Lasianthus rhinocerotis* subsp. *pedunculatus*** (Pitard) H. Zhu, Acta Bot. Yunnan. 20: 154. 1998.

有梗粗叶木 you geng cu ye mu

*Lasianthus rhinocerotis* var. *pedunculatus* Pitard in Lecomte, Fl. Indo-Chine 3: 395. 1924; *L. koi* Merrill & Chun.

Young branches and leaf abaxially densely hairy. Leaf blade papery to leathery, base broadly cuneate to truncate or subrounded; lateral veins 8–12 pairs; nervules densely anastomosing, parallel; stipules ± inconspicuous. Bracts relatively thick, linear to narrowly triangular.

Forests, shaded and wet places; 300–1000 m. Guangxi, Hainan, Yunnan [N Vietnam].

**26b. *Lasianthus rhinocerotis* subsp. *xishuangbannaensis*** H. Zhu & H. Wang, Acta Phytotax. Sin. 38: 282. 2000.

版纳粗叶木 ban na cu ye mu

Young branches and leaf abaxially sparsely hairy. Leaf blade papery, base rounded or slightly cordate; lateral veins 7 or 8 pairs; nervules loosely anastomosing, subreticulate; stipules triangular, ca. 3 mm. Bracts slender, filiform.

Montane forests, shaded and wet places; 1500–1600 m. S Yunnan [Thailand].

**27. *Lasianthus rigidus*** Miquel, Fl. Ned. Ind. 2: 321. 1857.

大叶粗叶木 da ye cu ye mu

*Lasianthus humilis* Elmer; *L. tentaculatus* J. D. Hooker.

Shrubs, height unknown; branchlets glabrous or subglabrous. Petiole 4–7 mm, sparsely hirsute; leaf blade papery or leathery, obovate-oblong, obovate, or oblong, 12–18 × 5–7 cm, glabrous adaxially, hirsute on midrib, lateral veins, and nervules abaxially, base ± oblique, obtuse, slightly cordate, or rounded, margin thinly recurved, apex shortly cuspidate-acuminate; lateral veins 8 or 9 pairs, elevated abaxially; nervules parallel, conspicuous abaxially; stipules persistent, triangular or subulate, 5–6 mm, hirsute. Inflorescences glomerulate, sessile, hirsute to hirtellous; bracts numerous, linear or linear-lanceolate to lanceolate, 9–12 mm, hirsute. Flowers sessile. Calyx sparsely hirsute; hypanthium portion campanulate, ca. 2 mm; limb ca. 2 mm; teeth 5, triangular, ca. 1 mm. Corolla ca. 1 cm, puberulent outside, pubescent inside in upper part; lobes 5. Fruit globose, 4–5 mm in diam., glabrous; pyrenes 5.

Forests, shaded and wet places; 500–700 m. Hainan, S Yunnan [NE India, Indonesia (Java, Sumatra), Philippines].

**28. *Lasianthus schmidtii*** K. Schumann, Bot. Tidsskr. 24: 340. 1902.

泰北粗叶木 tai bei cu ye mu

*Lasianthus kerrii* Craib.

Shrubs, 1–1.5 m tall; branches and branchlets densely tomentose to strigose. Petiole 4–9 mm, tomentose or strigose; leaf blade papery or rigid-papery, oblanceolate, elliptic-oblanceolate, or oblong, 5–10 × 2–4 cm, glabrous adaxially, tomentose or strigillose on midrib, nerves, and nervules abaxially, base cuneate, obtuse, or rounded, apex shortly acuminate or acute; lateral veins 5–7 pairs; nervules subreticulate; nerves and nervules elevated conspicuously abaxially; stipules subulate-triangular, 2–3 mm, tomentose or strigose. Inflorescence glomerulate, sessile; bracts subulate, 4–6 mm, tomentose or strigose. Flowers sessile. Calyx tomentose or strigose; hypanthium portion obconic, 1–1.5 mm; limb deeply lobed; lobes 4, triangular-subulate to lanceolate, 1.5–2 mm. Corolla ca. 9 mm; tube ca. 7 mm, sparsely strigillose outside; lobes 4, ca. 2 mm. Fruit blue, subglobose, 4–5 mm in diam., tomentose or strigillose; pyrenes 4.

Montane forests, shaded and wet places; 1000–1200 m. S Yunnan [N Thailand].

H. Zhu (Syst. & Geogr. Pl. 72: 79. 2002) noted that this species is rare and very similar to *Lasianthus sikkimensis*.

**29. *Lasianthus simizui*** (T. S. Liu & J. M. Chao) H. Zhu, Syst. & Geogr. Pl. 72: 92. 2002 [“*shimizui*”].

清水氏鸡屎树 qing shui shi ji shi shu

*Lasianthus obliquinervis* Merrill var. *simizui* T. S. Liu & J. M. Chao, Taiwania 10: 143. 1964; *L. trichophlebus* Hemsley var. *simizui* (T. S. Liu & J. M. Chao) H. Zhu.

Shrubs; branches and branchlets densely hirsute. Petiole 3–5 mm, hirsute; leaf blade leathery or subleathery, oblong or elliptic-oblong, 6–10 × 2.5–4 cm, glabrous adaxially, hirsute on midrib, nerves, and nervules abaxially, base acute, apex cuspidate or acute; lateral veins 6–8 pairs; nervules parallel; nerves and nervules elevated abaxially; stipules triangular-lanceolate, 3–5 mm, hirsute. Inflorescences sessile; bracts subulate, reduced. Flowers sessile. Calyx hirsute; hypanthium portion campanulate; limb ca. 2 mm, toothed for ca. 1/2; teeth 5, ca. 1 mm. Corolla not seen. Fruit subglobose, 5–6 mm in diam., subglabrous; pyrenes 5.

• Forests, shaded and wet places. Taiwan.

This species is similar to *Lasianthus trichophlebus* and *L. verticillatus*. It has stipules longer than in *L. verticillatus* and shorter than in *L. trichophlebus*, indumentum and a dentate calyx similar to *L. trichophlebus*, but 5-merous flowers and smooth fruit like *L. verticillatus*.

**30. *Lasianthus sikkimensis*** J. D. Hooker, Fl. Brit. India 3: 180. 1880.

锡金粗叶木 xi jin cu ye mu

*Lasianthus langkokensis* Drake ex Pitard; *L. sikkimensis* subsp. *langkokensis* (Drake ex Pitard) H. Zhu; *L. tsangii* Merrill ex H. L. Li.

Shrubs, 1–3 m tall; branches and branchlets densely brown tomentose or -villous. Petiole 6–14 mm, densely tomentose to villous; leaf blade subleathery or thinly leathery, elliptic-lanceolate or elliptic, 12–20 × 2.5–5 cm, glabrous adaxially, densely to moderately brown tomentose or villous to hirtellous abaxially, base acute or obtuse, margin usually thinly recurved,

apex cuspidate-acuminate; lateral veins 8–10 pairs; midrib and nerves elevated conspicuously abaxially; nervules subparallel, conspicuous abaxially; stipules generally persistent, triangular, 2–3 mm, densely tomentose to villous. Inflorescences glomerulate, sessile, 1–3-flowered, densely strigose to villous; bracts persistent, linear to lanceolate, 0.3–2 cm. Flowers sessile or subsessile. Calyx with hypanthium portion obconic, 1–2 mm, glabrous; limb 1–2 mm, hirtellous to strigillose, 5-lobed; lobes triangular. Corolla ca. 1 cm, puberulent outside. Fruit ellipsoid, 6–8 mm, glabrous, smooth or with ca. 5 low ridges; pyrenes 5. Fr. Jun, Oct.

Forests, shaded and wet places; 300–1600 m. Fujian, Guangdong, Guangxi, Taiwan, Yunnan, Zhejiang [Bangladesh, NE India, Philippines, Thailand, N Vietnam].

The combination of the glabrous fruit body and densely pubescent persisting calyx limb and the well-developed bracts on the sessile glomerulate inflorescences are distinctive for this species. H. Zhu (Syst. & Geogr. Pl. 72: 80. 2002) noted that the two subspecies of *Lasianthus sikkimensis* that were previously recognized have become difficult or impossible to separate now that more collections are available. Zhu (loc. cit.: 79) also noted that this species is very similar to *L. schmidtii*.

**31. *Lasianthus trichophlebus*** Hemsley, J. Linn. Soc., Bot. 23: 388. 1888.

钟萼粗叶木 zhong e cu ye mu

Shrubs, 1–2 m tall; branchlets strigillose to hirtellous. Petiole 5–8 mm, strigillose to hirsute; leaf blade leathery, oblong or elliptic-oblong, 8–15 × 3–5 cm, glabrous adaxially, strigillose or hirsute on midrib and nerves abaxially, base cuneate, apex cuspidate or acute; lateral veins 7–9 pairs; nervules parallel; nerves and nervules elevated abaxially; stipules triangular-lanceolate to narrowly triangular, 5–8 mm, densely strigillose. Inflorescences glomerulate, sessile; bracts absent. Flowers subsessile. Calyx strigillose to hirsute; hypanthium obconic to campanulate, ca. 2 mm; limb 1–1.5 mm, deeply 4-lobed; lobes narrowly triangular, ca. 1 mm. Corolla 6–8 mm, densely strigillose in upper half outside; lobes 4. Fruit subglobose, 5–6 mm in diam., verrucose, strigillose; pyrenes 4. Fl. Apr–May, fr. Sep–Oct.

Forests, shaded and wet places; ca. 100 m. Guangdong, Hainan, Taiwan [Indonesia, Malaysia (Peninsular), Philippines, Singapore, Thailand, Vietnam].

*Lasianthus trichophlebus* was often confused with both *L. chinensis* and *L. verticillatus*. However, it differs from *L. chinensis* by having leathery leaves with 7–9 pairs of lateral veins and parallel veinlets; stipules triangular-lanceolate, strigillose, 5–8 mm; flowers 4-merous; and pyrenes 4. It differs from *L. verticillatus* by having strigillose hairs on young branches and leaf nerves abaxially; stipules triangular-lanceolate, strigillose, 5–8 mm; flowers 4-merous; calyx with strigillose triangular lobes; and drupes with 4 pyrenes and verrucose on external surface.

- 1a. Branches densely hirsute, leaves pubescent abaxially ..... 31a. var. *latifolius*  
 1b. Branches sparsely strigillose; leaves abaxially glabrous except strigillose or hirsute on midrib and nerves ..... 31b. var. *trichophlebus*

**31a. *Lasianthus trichophlebus* var. *latifolius*** (Miquel) H.

Zhu, Syst. & Geogr. Pl. 72: 93. 2002.

栖兰钟萼粗叶木 qi lan zhong e cu ye mu

*Lasianthus sylvestris* Blume f. *latifolius* Miquel, Ann. Mus. Bot. Lugduno-Batavi 4: 248. 1869 [*“latifolia”*]; *L. hiranensis* Hayata; *L. lei* Merrill & F. P. Metcalf ex H. S. Lo.

Branches densely hirsute. Leaves pubescent abaxially.

Forests, shaded and wet places. Hainan, Taiwan [Indonesia (Java, Sumatra), Malaysia (Peninsular), Philippines, Singapore, Thailand, Vietnam].

This taxon was treated as *Lasianthus tomentosus* Blume by King and Gamble (J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73: 130. 1904), Ridley (Fl. Malay Penin. 2: 161. 1923), Craib (Fl. Siam. 2(2): 219. 1934), and H. Zhu (Acta Bot. Yunnan. 20: 155. 1998), which may be due to the authors following two misidentified sheets in K. These two specimens, which are labeled as *Horsfield s.n.* [Rub. 50] from Java, are indicated as “*L. tomentosus* Blume” with Miquel’s handwriting and also were cited as such in print (Miquel, Fl. Ned. Ind. 2: 318. 1857). Miquel (loc. cit. 1869) later changed his mind and considered that they were not the same as *L. tomentosus*. The type materials of *L. tomentosus* are only in Leiden and there are no overseas duplicates. After examining Malaysian specimens and carefully comparing with the type of *L. tomentosus*, it is recognized that the taxon that was mistaken for *L. tomentosus* has conspicuous, strigose, linear-lanceolate stipules, 4-merous flowers, hirsute and verrucose drupes with 4 pyrenes, and is more closely related to *L. trichophlebus* than *L. tomentosus*. The taxon differs from *L. trichophlebus* by having only dense hirsute hairs on the branches and pubescent hairs on the abaxial leaf surface. It is better, therefore, to treat this taxon as a variety of *L. trichophlebus*.

**31b. *Lasianthus trichophlebus* var. *trichophlebus***

钟萼粗叶木(原变种) zhong e cu ye mu (yuan bian zhong)

*Lasianthus barbellatus* Ridley; *L. cupreus* Pierre ex Pitard.

Branches sparsely strigillose. Leaves glabrous except strigillose or hirsute on midrib and nerves abaxially.

Forests, shaded and wet places. Guangdong [Indonesia, Malaysia (Peninsular), Philippines, Thailand, Vietnam].

**32. *Lasianthus verticillatus*** (Loureiro) Merrill, Trans. Amer. Philos. Soc., n.s., 24: 372. 1935.

斜脉粗叶木 xie mai cu ye mu

*Dasus verticillatus* Loureiro, Fl. Cochinch. 1: 142. 1790; *Lasianthus andamanicus* J. D. Hooker; *L. taitoensis* Simizu; *L. tamirensis* Pierre ex Pitard.

Shrubs, 1.5–3 m tall; branches and branchlets appressed pubescent or strigillose to glabrescent. Petiole 7–10 mm, densely pubescent or strigillose to strigose; leaf blade leathery, oblong to elliptic-oblong, 8.5–18 × 3.5–7 cm, glabrous adaxially, thinly pubescent or strigillose abaxially, base acute to broadly obtuse, margins usually undulate, often thinly revolute, apex acute or acuminate; lateral veins 7–9 pairs; nervules parallel; nerves and nervules elevated conspicuously abaxially; stipules generally persistent, triangular to narrowly triangular, 3–5 mm, densely puberulent to strigillose. Inflorescences subcapitate to congested-cymose, sessile; bracts absent or reduced. Flowers sessile to subsessile. Calyx subglabrous or puberulent;

hypanthium portion campanulate to subglobose, 2.5–3 mm; limb 2–2.5 mm, truncate or minutely dentate. Corolla 10–12 mm, hirtellous to villous outside, villous inside; lobes 5, ovate. Fruit blue, ellipsoid, up to 10 mm in diam., strigillose to glabrescent, smooth; pyrenes 4 or 5. Fl. Apr–May, fr. Oct–Nov.

Forests, shaded and wet places; 100–1000 m. Guangdong, Guangxi, Hainan, Taiwan, Yunnan [Cambodia, India (Andaman and Nicobar Islands), Indonesia, Japan (Ryukyu Islands), Laos, Malaysia, Myanmar, Philippines, Thailand, Vietnam].

The relatively large flowers with the large globose to ellipsoid hypanthium (i.e., ovary) portion are distinctive; *Lasianthus chinensis* is similar in these characters but can be distinguished by its deeply lobed calyx limb and angled to ridged fruit.

Specimens from mainland SE China, Taiwan, and Ryukyu Islands that have been treated as “*Lasianthus obliquinervis* Merrill” are clearly conspecific with *L. verticillatus*. In Merrill’s description (Philipp. J. Sci. 1(Suppl. 1): 136. 1906), *L. obliquinervis* is described as having oblong-ovate stipules ca. 5 mm and fruit with 6 triquetrous pyrenes, which does not match *L. verticillatus*. *Lasianthus obliquinervis* represents a different species with distribution in the Philippines and Papua New Guinea. The so-called “*L. obliquinervis*” from China, Taiwan, and the

Ryukyus in Chinese and Japanese literature is a misidentification of the species *L. verticillatus*.

**33. *Lasianthus wardii*** C. E. C. Fischer & Kaul, Bull. Misc. Inform. Kew 1940: 292. 1941.

滇西粗叶木 dian xi cu ye mu

Shrubs, height unknown; branchlets fuscous tomentose. Petiole 5–10 mm, tomentose; leaf blade papery, dark olivaceous adaxially, elliptic-oblong to oblanceolate-oblong, 12–17 × 3.5–6 cm, glabrous adaxially, brown- or fuscous tomentose abaxially especially on nerves, base cuneate, apex caudate-acuminate; lateral veins ca. 7 pairs, elevated abaxially; nervules subreticulate; stipules broadly ovate, cuspidate. Inflorescences glomerulate, sessile; bracts absent. Flowers sessile. Calyx brown tomentose; hypanthium portion campanulate, very short; limb deeply lobed; lobes 5, oblong, ca. 3 mm, obtuse. Corolla shortly brown tomentose outside; tube up to 1.6 cm, whitish- or brownish pilose in upper half inside; lobes 5, triangular-ovate, ca. 4.5 mm. Fruit not seen.

Forests, shaded and wet places. Yunnan [Myanmar].

H. Zhu (Syst. & Geogr. Pl. 72: 83–84. 2002) cited only three specimens in total of this species, which suggests that it is rare.

#### 44. LEPTODERMIS Wallich in Roxburgh, Fl. Ind. 2: 191. 1824.

野丁香属 ye ding xiang shu

Chen Tao (陈涛)

Shrubs, sometimes low or reduced, unarmed, usually with short shoots. Raphides present. Leaves opposite, apparently without domatia; stipules persistent, interpetiolar, triangular, often aristate to spinescent. Inflorescences terminal on main stems and/or axillary short shoots (and then appearing axillary), capitate to congested-fasciculate or -cymose and several flowered or sometimes reduced to 1 flower, bracteate with bracts often fused in pairs. Flowers sessile to shortly pedicellate, bisexual, distylous. Calyx limb (4 or)5(or 6)-lobed. Corolla white to pink or purple, funnellform, inside glabrous to pubescent; lobes (4 or)5(or 6), valvate or valvate-induplicate in bud. Stamens (4 or)5(or 6), inserted in corolla throat, exerted or included; filaments short; anthers dorsifixed. Ovary 5-celled, ovules 1 in each cell, basal, erect, anatropous; stigmas (2 or)3–5(or 6), linear, exerted or included. Fruit capsular, ellipsoid to ovoid, opening through an apical operculum then splitting longitudinally into 5 valves, cartilaginous to woody, calyx limb persistent; aril reticulate, free or adherent to seed; seeds few, medium-sized, ellipsoid, straight, with thin testa; cotyledons rounded; radicle short, inferior.

About 40 species: Himalaya to Japan; 34 species (30 endemic) in China.

1a. Aril free from testa (fruit of *L. brevisepala* and *L. dielsiana* not seen).

2a. Bracteoles free.

3a. Stipules compressed triangular, shortly acuminate; bracteole longer than calyx ..... 5. *L. dielsiana*

3b. Stipules long triangular, acuminate; bracteole shorter than calyx or subequal in length ..... 26. *L. scissa*

2b. Bracteoles connate.

4a. Bracteoles connate from base to middle.

5a. Bracteoles longer than calyces or nearly as long as calyces.

6a. Flowers mostly terminal on branches or laterally arranged; calyx lobes lanceolate-subulate, acuminate or shortly acuminate, glabrous; corolla funnellform, lobes not incurved at apex; stamens inserted in corolla tube throat ..... 8. *L. glomerata*

6b. Flowers 3 terminal on branches; calyx lobes short or long triangular or subovate, very acute, ciliate; corolla narrowly funnellform, lobes incurved at apex; stamens inserted below corolla tube throat.

7a. Calyx lobes short or long triangular ..... 14. *L. limprichtii*

7b. Calyx lobes subovate ..... 21. *L. pumila*

5b. Bracteoles shorter than calyces.

8a. Leaves thickly papery, glabrous; stipules subtriangular; calyx lobes not ciliate ..... 2. *L. brevisepala*

8b. Leaves papery, pilose; stipules broadly triangular, glandular on margins; calyx lobes ciliate.

- 9a. Stipules with stiff acicular apiculus, sometimes with stipitate glands on margins; corolla lobes triangular-oblate, apex obtuse; stamens inserted in corolla tube throat ..... 29. *L. velutiniflora*
- 9b. Stipules with acicular apiculus, with 2 glandular teeth; corolla lobes ovate-triangular, apex reflexed; stamens inserted below corolla tube throat ..... 20. *L. potaninii*
- 4b. Bracteoles 1/2–2/3 connate.
- 10a. Bracteoles equal or subequal in length to calyces; corolla lobes inflexed at apex.
- 11a. Flowers with pedicels, 3–9 mm ..... 28. *L. umbellata*
- 11b. Flowers sessile or subsessile.
- 12a. Corolla small, 11–14 mm; free portion of bracteole triangular ..... 16. *L. oblonga*
- 12b. Corolla large, to ca. 16 mm; free portion of bracteole broadly triangular ..... 9. *L. gracilis*
- 10b. Bracteoles longer than calyces; corolla lobes not inflexed at apex.
- 13a. Stigmas 3-lobed, filiform.
- 14a. Leaves thickly papery; bracteoles sparsely ciliate; calyx lobes shortly acuminate; corolla purplish red, lobes 4 or 5, ovate-lanceolate; stamens inserted above corolla tube throat ..... 17. *L. ordosica*
- 14b. Leaves leathery; bracteoles pilose; calyx lobes obtuse; corolla white, lobes 5, sublanceolate; stamens inserted below corolla tube throat ..... 24. *L. scabrida*
- 13b. Stigmas 5-lobed, linear.
- 15a. Leaves papery, 3–10 cm, petioles ca. 24 mm; calyx lobes triangular-ovate; corolla lobes with 3 obtuse teeth, incurved ..... 12. *L. kumaonensis*
- 15b. Leaves subleathery or leathery, to 4 cm, petioles 4–7 mm; calyx lobes broadly oblong to suborbicular; corolla lobes obtuse.
- 16a. Leaves ovate to broadly lanceolate, whitish or pale yellow abaxially when dry, veinlets indistinct abaxially ..... 4. *L. coriaceifolia*
- 16b. Leaves ovate, ovate-oblong, elliptic, or suborbicular, pale green or iron-gray abaxially when dry, veinlets conspicuous abaxially.
- 17a. Flowers 3–7 fascicled, terminal or in axils of upper 3–6 pairs of leaves, subsessile or pedicels 0.3–2.6 mm ..... 30. *L. vestita*
- 17b. Flowers (1–)3–5 fascicled, terminal on ultimate branches of inflorescence, forming a thyrse, pedicels to 8 mm ..... 33. *L. yangshuoensis*
- 1b. Aril adherent to testa.
- 18a. Bracteoles separated, scaly ..... 1. *L. beichuanensis*
- 18b. Bracteoles connate.
- 19a. Bracteoles nearly as long as corolla.
- 20a. Stigmas 2-lobed ..... 13. *L. lanata*
- 20b. Stigmas 5-lobed.
- 21a. Bracteoles tomentose.
- 22a. Bracteoles slightly longer than calyces; calyx lobes ovate, acuminate ..... 10. *L. handeliana*
- 22b. Bracteoles shorter than calyces; calyx lobes ovate-oblong, slightly obtuse ..... 27. *L. tomentella*
- 21b. Bracteoles pubescent or ciliate on upper portion.
- 23a. Leaves 1–4 × ca. 2 cm, petioles to 1 cm; bracteoles subulate-acuminate at apex .... 23. *L. rehderiana*
- 23b. Leaves 4–9 × 1.25–2 mm, petioles very short or subsessile; bracteoles rounded at apex, apiculate ..... 25. *L. schneideri*
- 19b. Bracteoles obviously longer or shorter than calyces.
- 24a. Bracteoles obviously longer than calyces.
- 25a. Stigmas usually 3-lobed ..... 32. *L. xizangensis*
- 25b. Stigmas usually 5-lobed.
- 26a. Leaves glabrous on both surfaces.
- 27a. Stipules triangular, glabrous; flowers subsessile; calyx lobes densely fimbriate-ciliate; corolla pallid purple, narrowly funnelform, lobes lanceolate; stamens inserted above corolla tube throat ..... 3. *L. buxifolia*
- 27b. Stipules ovate-triangular, covered with soft hairs; flowers with pedicel 3–5(–8) mm; calyx lobes shortly ciliate; corolla purplish blue, funnelform, lobes broadly ovate; stamens inserted below corolla tube throat ..... 6. *L. diffusa*
- 26b. Leaves hairy on both surfaces, at least ciliate along margins.
- 28a. Stipules compressed triangular or triangular, acuminate, apiculus rarely with 1 or 2 lateral glandular teeth; calyx lobes acuminate ..... 10. *L. handeliana*
- 28b. Stipules broadly triangular, cuspidate-apiculate; calyx lobes obtuse to truncate ..... 19. *L. pilosa*

- 24b. Bracteoles obviously shorter than calyces.
- 29a. Stigmas more than 3-lobed.
- 30a. Corolla lobes subovate, apex inflexed and beaked ..... 11. *L. hirsutiflora*
- 30b. Corolla lobes ovoid-lanceolate, apex mucronate or slightly obtuse.
- 31a. Leaves slightly thick; bracteoles abruptly acuminate at apex; calyx lobes triangular-lanceolate; corolla lobes acute, margins revolute ..... 18. *L. parvifolia*
- 31b. Leaves papery, margins obviously recurved; bracteoles abruptly acute; calyx lobes oblong-ovate; corolla lobes slightly obtuse ..... 22. *L. purdomii*
- 29b. Stigmas 2- or 3-lobed.
- 32a. Corolla broadly funnelform; stamens inserted below corolla tube throat.
- 33a. Stipules apiculate at apex, sparsely pilose at base; bracteole lobes triangular; corolla white, pallid pink, or purple, lobes apically inflexed and beaked ..... 15. *L. ludlowii*
- 33b. Stipules lacerate at apex, with glandular hairs along margins; bracteole lobes lanceolate or ensiform-lanceolate; corolla purple, lobes shallowly 3-parted at apex, margins wavy ..... 34. *L. yui*
- 32b. Corolla funnelform; stamens inserted in corolla tube throat.
- 34a. Stipules with fimbriate collaters along margins; corolla pallid blue or purplish or purplish red; stigmas 2-lobed ..... 7. *L. forrestii*
- 34b. Stipules usually glandular along margins; corolla white or pallid red, stigmas 3-lobed ..... 31. *L. wilsonii*

**1. *Leptodermis beichuanensis*** H. S. Lo, J. Trop. Subtrop. Bot. 7(1): 19. 1999.

北川野丁香 *bei chuan ye ding xiang*

Shrubs, ca. 2 m tall; branches slender, terete, gray or grayish brown, with 2 bands of soft hairs. Petiole 1–3 mm; leaf blade papery, olive-green when dry, narrowly lanceolate or oblong-lanceolate, sometimes subovate or elliptic, 0.8–3.5 × 0.3–1 cm, slightly scabrous adaxially, midrib strigose abaxially, base cuneate, apex acuminate or acute; midrib and lateral veins slightly prominent on both surfaces, lateral veins 3 or 4 pairs; stipules small, subtriangular, ca. 1 mm, stiffly apiculate, usually caducous. Flowers 1–3 terminal, sessile; bracteoles scaly, shorter than 1 mm, stiffly apiculate. Calyx tube ca. 1.8 mm; lobes broadly triangular, width longer than length, ca. 0.6 mm, sometimes margins denticulate. Immature fruit subobovate, ca. 3 mm; seed aril adherent to testa.

• About 1400 m. NC Sichuan (Beichuan).

**2. *Leptodermis brevisepala*** H. S. Lo, J. Trop. Subtrop. Bot. 7(1): 21. 1999.

短萼野丁香 *duan e ye ding xiang*

Shrubs, ca. 40 cm tall; branchlets terete, erect and long, ferruginous, pubescent or puberulent. Leaves sparsely arranged or 4 fascicled at tips of branchlets; petiole 1–2 mm or sometimes leaves subsessile; blade thickly papery, nearly black adaxially and dark brown abaxially when dry, ovate or lanceolate, 6–10 × 3–5 mm, both surfaces glabrous, margins slightly revolute, apex shortly acuminate or subacute, rarely obtuse; lateral veins 3 or 4 pairs, together with midrib conspicuously prominent abaxially; stipules subtriangular, ca. 1.6 mm, subglabrous, with a long stiff apiculus. Cymes almost sessile, terminal on short branches, sometimes axillary, 5–7-flowered. Flowers subsessile or shortly pedicellate; bracteoles transparent, connate below middle portion, subequal to calyx tube in length, subglabrous or puberulent, with a stiff acicular apiculus. Calyx tube black when dry, 1.4–1.7 mm; lobes 5, ovate-orbicular or ovate-triangular,

length subequal to width, ca. 0.4 mm, not ciliate, obtuse or subacute. Corolla white, funnelform, 8–10 mm, puberulent outside, densely white villous inside; lobes 5, suborbicular, margins wavy or erose. Stamens 5, inserted below throat of corolla tube; anthers linear, included. Style exerted; stigmas usually 3-lobed, involute.

• About 1800 m. Sichuan (Huili).

**3. *Leptodermis buxifolia*** H. S. Lo, J. Trop. Subtrop. Bot. 7(1): 20. 1999.

黄杨叶野丁香 *huang yang ye ye ding xiang*

*Leptodermis buxifolia* f. *strigosa* H. S. Lo.

Shrubs, 0.5–2 m tall; branches terete, slightly stout, black or dark gray, glabrous, branches slightly elongate or abbreviated. Leaves sparse or fascicled in axils of short branches; petiole short or nearly absent; blade thickly leathery, ovate, lanceolate, elliptic, or oblong, 5–8(–12) × 2–5(–8) mm, both surfaces glabrous, shiny, margins recurved, apex obtuse or rounded, sometimes subacute; midrib raised abaxially, lateral veins inconspicuous; stipules triangular, ca. 1.2 mm, glabrous. Cymes terminal or axillary, usually 3-flowered, sometimes in narrow thyrses. Flowers subsessile; bracteoles transparent, ca. 2 mm, ca. 3/4 connate, lobes short, with prominent tip, glabrous. Calyx small; tube ca. 1 mm; lobes oval, 0.4–0.5 mm, densely fimbriate-ciliate. Corolla light purple, narrowly funnelform, 9–10(–14) mm; tube slender, pulverulent pubescent outside, pilose inside, often pendulous; lobes 5, lanceolate, ca. 2 mm. Stamens 5, inserted above corolla tube throat; anthers filiform, exerted. Style ca. 1/2 as long as corolla; stigmas (2 or) 5-lobed, lobes filiform, included. Fruit 4–4.5 mm; seed aril reticulate, adherent to testa. Fl. Jul–Aug, fr. Aug–Sep.

• Thickets, dry mountain slopes; 1100–2100 m. Gansu, SW Shaanxi, Sichuan.

**4. *Leptodermis coriaceifolia*** Tao Chen, *sp. nov.*

革叶野丁香 *ge ye ye ding xiang*

Type: China. Yunnan: Xichou Xian (西畴县) ["Si-chour-hsien"], Fadou (法斗) ["Faa-doo"], 1500 m, in open thickets on rock hill, 26 Sep 1947, K. M. Feng 12065 (holotype, A; isotypes, IBSC, KUN).

*Haec species* Leptodermidi vestitae Hemsley similis, sed ab ea folii lamina ovata vel late lanceolata crassa in sicco coriacea ac abaxialiter albida vel pallide lutea, venis lateralibus abaxialiter indistinctis vel parum prominentibus, venulis adaxialiter plerumque distinctis abaxialiter indistinctis, pedunculo hirsuto vel glabrescente, pedicellis dense hirsutis, bracteolis crassiusculis plerumque non hyalinis margine prope apicem conspicue ciliato, corolla extus sparsim minuteque hirsuta trichomatibus sparsis longioribus prope alabastrum apicem atque stylo 3- usque 5-lobato differt.

Shrubs to 1.2(–3) m tall. Stems dark brown, glabrescent, lenticellate; branches many, young branches pale yellow when dry, with 2 bands of sparse hairs decurrent from stipules; bark gray, fissured and peeling off when old. Leaves decussate; petiole short, to 0.7 mm, sparsely hairy to glabrous; blade dark green adaxially, whitish or pale yellow abaxially when dry, ovate to broadly lanceolate, 1–6 × 0.5–2.5 cm, thick, leathery when dry, glabrous on both surfaces or sparsely hairy along midvein, base attenuate, cuneate, margins sparsely hairy, apex acuminate to acute; midvein impressed adaxially, prominent abaxially, lateral veins distinct adaxially, indistinct or slightly prominent abaxially, with 4–8 veins per side, veinlets usually distinct adaxially, indistinct abaxially; stipules rigid, broadly triangular, ca. 1 mm, hairy abaxially, cuspidate, mucronate at apex. Inflorescences terminal on new shoots with all upper nodes bearing 2–4 lateral shoots with axillary and terminal clusters of cymules 3–9-flowered, forming a narrow thyrse with an elongate central axis and short lateral branches; peduncle hairy or glabrescent; bracts of cymules ligulate or leaflike, 1–4.5 mm or longer, with a midvein slightly prominent abaxially, margins hairy, apex acuminate to acute. Flowers heterostylous, subsessile or shortly pedicellate; pedicel densely hairy; bracteole pairs rigid, slightly thick, usually not transparent, obovate, ca. 3 mm, longer than or subequal to calyx at anthesis, connate for ca. 3/4 length, few veined, minutely short and sparsely hairy abaxially, margins conspicuously ciliate near apex, apex acute to obtuse, shortly mucronulate. Calyx tube absent; lobes 5, ovate, ca. 1 mm, margins long ciliate, apex acute. Corolla purplish white; tube narrowly funnelliform, ca. 10 mm, outside sparsely minutely hairy, with sparse longer hairs near apex of flower buds, inside villous above middle of tube; lobes 5, ovate-oblong, ca. 3 mm, veined, lower part with thinner margins, upper part triangular, apex shortly acuminate, hooked. Long-styled flower: stamens inserted at throat ca. 1.5 mm from sinus, filaments attached to lower 1/3 of anthers, free part shorter than lower portion of anthers, anthers ca. 1.5 mm, introrse; style ca. 12 mm, glabrous, 3(–5)-lobed, lobes ca. 1 mm, papillose. Capsule ca. 6 mm; seeds with reticulate aril free from testa. Fl. Sep–Oct, fr. Nov–Dec.

Open thickets on limestone hills; 300–1700 m. Guangxi, Yunnan [Vietnam].

**5. *Leptodermis dielsiana*** H. J. P. Winkler, Repert. Spec. Nov. Regni Veg. 18: 151. 1922.

丽江野丁香 li jiang ye ding xiang

Small shrubs, 8–50 cm tall, with rootlike flagella; young branches not lignified, red, puberulent, old branches glabrescent, with gray bark, short branches 3–10 mm, sometimes longer, with 2 or 3 pairs of leaves. Leaves sparsely arranged on long branches, crowded on lateral short branches, smaller on lower part of both short and long branches; petiole 2–6 mm, pubescent; blade sometimes suborbicular, 6–15 × 4–12 mm, on upper part of branches ovate or oblong, 10–30 × 5–15 mm, covered with conical hairs except pubescent on midrib adaxially, glabrous or sparsely hairy on nerves abaxially, base attenuate to petiole, apex acute or slightly obtuse, apiculate; lateral veins 3–5 pairs, confluent in arcs; stipules membranous, ca. 1.5 mm, with 2 dominant veins parallel to margins and confluent at apex, stipules on upper part, especially on inflorescences, compressed triangular, shortly acuminate, with 2 glandular teeth near apex, 2 others slightly apart, stipules on lower part usually without glandular teeth, ciliate at base, very shortly puberulent. Flowers 1–3 terminal on very short branches, sometimes 1 or 2 flowers axillary in axils of upper leaf pair; pedicels covered with papillose scabrid hairs; bracteoles 2, free, sessile, transparent, ovate-oblong or oblong, 2.5–3.5 mm, longer than calyx, puberulent, ciliate on upper part, with veins percurrent, apiculate. Calyx lobes 5(or 6), submembranous, oblong, veined, ciliate, apiculate or slightly obtuse. Corolla large, 15–17 mm; tube funnelliform, shortly papillose near base outside, villous, glabrous at base inside; lobes 3–4 × shorter than corolla tube, ovate-orbicular, 4–5 mm, glabrous outside, villous inside, not reflexed, margins wavy. Stamens inserted in corolla tube throat; filaments attached to middle of anthers, slightly longer than base of anthers; anthers linear, included or semi-exserted. Style 5-lobed, glabrous, lobes relatively long, with long papilla, included or exserted. Fl. May.

• NW Yunnan (Dali, Lijiang, Yongning).

**6. *Leptodermis diffusa*** Batalin, Trudy Imp. S.-Peterburgsk. Bot. Sada 13: 373. 1894.

文水野丁香 wen shui ye ding xiang

Shrubs, 1–1.5 m tall; branchlets often diffuse, together with peduncles and pedicels puberulent, terete. Petiole to 4 mm; leaf blade silver-gray or grayish yellow adaxially when dry, pale abaxially, ovate-lanceolate to elliptic, 18–40 × 8–15 mm, both surfaces glabrous, base attenuate or cuneate, apex acute or obtuse; midrib prominent below, lateral veins 4 pairs, slightly conspicuous; stipules ovate-triangular, ca. 1.5 mm, with soft hairs. Flowers terminal and in axils of upper leaves, subumbellate, usually many in a terminal, large, much-flowered panicle; pedicels usually 3–5(–8) mm; bracts purplish blue, turning brown on margins, longer than calyces, 3–3.5 mm, glabrous or hairy, membranous, connate to above middle, free portion very shortly bilabiate, labellum short, apiculate. Flowers dimorphic, heterostylous. Calyx lobes orbicular, shortly ciliate. Corolla purplish blue, funnelliform, 16–18 mm, puberulent outside, sparsely pubescent inside; lobes more than 3 × shorter than tubes, broadly ovate, ca. 3.5 × 3.2 mm, abruptly acute, spreading. Anthers ca. 2.5 mm, slightly exserted in short-styled flowers; filaments as long as anthers, inserted in upper portion of calyx

tube. Style exerted in long-styled flowers, filiform, glabrous; stigmas 5-lobed, linear. Immature capsule broader and longer than bracts. Fl. Aug, fr. Sep–Oct.

• Rocks at streamsides; 600–1300 m. S Gansu (Wenxian), S Sichuan.

**7. *Leptodermis forrestii*** Diels, Notes Roy. Bot. Gard. Edinburgh 5: 274. 1912.

高山野丁香 gao shan ye ding xiang

Shrubs, 0.6–1.2 m tall, much branched; old branches gray or slightly reddish, bark peeling off, young branches slender, with 2 opposite shallow longitudinal channels, densely covered with short soft hairs. Leaves petiolate or sometimes subsessile; petiole shorter than 2 mm; blade membranous-papery, ± black or sometimes brownish when dry, ovate or lanceolate, rarely oblong or broadly ovate, 1–3 × 0.6–1.5 cm, dispersedly strigose adaxially, glabrous or with crinkled long soft hairs on midrib and lateral veins abaxially, rarely entirely hairy, base usually sharply contracted, attenuate into short stalk, apex acute to sub-acuminate; lateral veins 4–6 pairs, slender, obvious abaxially; stipules triangular or compressed triangular, 2–2.5 mm, pubescent outside, margins with fimbriate collaters, with 2 nerves arching upward and joining at apiculate apex. Flowers usually solitary, terminal, sessile, dimorphic, heterostylous; short-styled flowers: bracts 2, small, ca. 1.5 mm, usually connate, awned apiculate. Calyx black when dry, shiny; lobes 5, narrowly and long triangular, 3.8–4 mm, slightly thick, glabrous or sparsely ciliate on upper portion, equal to calyx in length or slightly shorter. Corolla light blue or slightly reddish, funnellform, 20–22 mm, glabrous outside, white villous inside; limb broad, spreading; lobes 5, induplicate, elliptic, ca. 6 mm, with an in-crasate area in center, lateral areas thin, soft, equal to in-crasate area in length, with branched venation, margins with erose teeth, apex ?apiculate. Stamens 5, inserted in throat of corolla tube; filaments ca. 1.5 mm; anthers linear, ca. 2.7 mm, apex slightly exerted from tube. Style ca. 10 mm; stigmas 2-lobed, lobes linear, ca. 2.7 mm. Capsules ca. 5 mm; seeds black; aril reticulate, adherent to testa.

• Forests; 3200–3400 m. Sichuan, SE Xizang (Bomi, Nyingchi), NW Yunnan (Lijiang).

**8. *Leptodermis glomerata*** Hutchinson in Sargent, Pl. Wilson. 3: 406. 1916.

聚花野丁香 ju hua ye ding xiang

Small shrubs, up to 60 cm or slightly taller; stems branched at base, branches erect, slender, usually purplish red, with hairs in 2 opposite bands, internode 3–4 cm or longer. Leaves opposite; petiole 1–2 mm or longer; blade thinly papery, lanceolate or ovate-lanceolate, sometimes ovate, 1–5 × 0.6–2 cm, glabrous or scabrid at margins adaxially, subglabrous abaxially, reticulately veined, base very pointed, apex acute or acuminate; lateral veins 4–6 pairs, arched, prominent abaxially; stipules broad at base, long cuspidate upward, 2.5–4 mm, sparsely hairy near base or subglabrous outside. Flowers congested at tips of branches, sessile or conspicuously petiolate for lateral flowers, dimorphic, heterostylous; long-styled flowers with bracteoles membranous, opposite, connate at

base, 2.5 mm or slightly shorter, glabrous, abruptly subulate-acuminate. Calyx turning black when dry; tube 2–2.2 mm, glabrous; lobes 5, lanceolate-subulate, ca. 2 mm, stiff, glabrous, usually not ciliate, acuminate or acute. Corolla tube slightly curved, ca. 1 cm, dilated upward, pubescent outside, sparsely pubescent on throat; lobes 5, ovate, ca. 3.5 × 2.5 mm, obtuse and apiculate. Stamens 5, inserted in throat of corolla tube; filaments ca. 2.8 mm; anthers ca. 3 mm, slightly exerted. Style glabrous, 10–11 mm; stigmas 5-lobed, lobes ca. 1 mm; short-styled flowers: style ca. 5 mm, stigmas 3–5-lobed, lobes linear, 2.5–5 mm. Capsule narrowly ellipsoidal, persistent calyx lobes ca. 9 mm, 5-ridged, pale brown, glabrous, 5-valved when mature, with 5 utricle-like pyrenes; seeds linear, embedded in reticulate aril; aril free from testa.

• Sparse forests, hill slopes; 1800–2500 m. Yunnan.

**9. *Leptodermis gracilis*** C. E. C. Fischer, Bull. Misc. Inform. Kew 1940: 293. 1941.

柔枝野丁香 rou zhi ye ding xiang

Shrubs, 1.5–2 m tall; branches slender, usually nodding, grayish white, pubescent. Leaves opposite; petiole 2–6 mm; blade papery, silver-gray adaxially, slightly pallid abaxially, elliptic to lanceolate, 1.4–3.5 × 5–13 mm, adaxially glabrous except sometimes hispid on midrib and margin, abaxially usually hairy on midrib and lateral veins, margins hispidulous ciliate, base cuneate, ± decurrent, apex acute; stipules interpetiolar, broad at base, long cuspidate upward, ca. 3 mm, puberulent, ciliate. Cymes terminal and axillary on upper portion of branchlets; peduncle ca. 3.5 mm; flowers 3 fascicled, sessile; bracts narrowly elliptic-lanceolate, ca. 4 mm, ciliate, acute; bracteoles 2, connate into a sheath ca. 2.5 mm, free portion broadly ovate, 1–1.5 mm, 3-nerved, apiculate. Calyx tube turbinate, 5-ridged, 1.2–1.5 mm; lobes 5, oblong, ca. 1.2 mm, ciliate, rounded or subtruncate. Corolla white or purple, narrowly funnellform; tube slender, ca. 8 mm, pilose above base inside; lobes 5, gladiate, ca. 1.5 mm, subacute. Stamens 5, inserted in corolla tube throat; anthers sessile, linear, ca. 1.5 mm, included. Style slender; stigmas 3, filiform, 1–1.5 mm, papillose, slightly exerted. Capsules linear-oblong, ca. 5 mm, dehiscent in 5 valves; seeds not seen.

• Thickets, hill slopes; 1000–2700 m. NC Sichuan, SE Xizang.

1a. Flowers smaller; corolla ca. 9.5 mm ..... 9a. var. *gracilis*

1b. Flowers larger; corolla ca. 16 mm ..... 9b. var. *longiflora*

**9a. *Leptodermis gracilis* var. *gracilis***

柔枝野丁香(原变种) rou zhi ye ding xiang (yuan bian zhong)

Flowers smaller; corolla ca. 9.5 mm. Fl. Jul.

• Hill slopes; 1000–2400 m. SE Xizang (Bomi, Mêdog, Zayü).

**9b. *Leptodermis gracilis* var. *longiflora* H. S. Lo, var. nov.**

长花野丁香 chang hua ye ding xiang

Type: China. Sichuan: Barkam (Maerkang, 马尔康), Zhoukeji (卓克基), 2650 m, 30 Jul 1957, Z. Y. Zhang & H. F. Zhou 23393 (holotype, SZ; isotype, KUN).

Validating Latin diagnosis: that of "*Leptodermis gracilis* C. E. C. Fischer var. *longiflora* Lo" (H. S. Lo in W. C. Chen, Fl. Reipubl. Popularis Sin. 71(2): 338. 1999).

Flowers larger, corolla ca. 16 mm. Fl. Jul.

- Thickets; 2600–2700 m. NC Sichuan (Barkam).

This name was previously published by H. S. Lo (loc. cit.) but not validly so because no type was indicated (*Vienna Code*, Art. 37.1).

**10. *Leptodermis handeliana*** H. J. P. Winkler in Handel-Mazzetti, Symb. Sin. 7: 1025. 1936.

川南野丁香 chuan nan ye ding xiang

Shrubs; young branches with 2 bands of short woolly hairs, old branches glabrescent, bark gray, longitudinally lacerate. Leaves sparsely arranged on branches 3–10 cm, with sparse and long internodes, very rarely crowded on short branches; blade slightly thick, broadly ovate, elliptic, or broadly elliptic, 7–18 × 4–11 mm, adaxially tomentose on midrib, abaxially with scattered bristles on lateral veins, very shortly setiform ciliate on margins, base abruptly contracted and attenuate into petiole, apex acute or abruptly shortly acuminate; lateral veins 4–6 pairs, ascending; stipules membranous-leathery, triangular on lower part, compressed triangular on upper part, acuminate, apiculus seldom with 1 or 2 lateral glandular teeth, 1–2 mm, 2 veins joining at tip, dorsal surface densely tomentulose, ventral surface densely covered with glandular appendages. Flowers 5–7 terminal on branches, sessile, highest node with 1 or 3 flowers in axils of leaves, next node with 1 or 2 lateral branches terminated dichotomously with flowers; bracts especially of flowers in center somewhat leaflike, 4–5 mm, slightly longer than calyx, with midrib and reticulate veins, tomentose, connate below middle part, acuminate. Calyx ca. 3 mm; lobes 5, ovate, ciliate, acuminate. Young corolla hispidulous outside. Stigmas 5-lobed. Fl. Jun.

- S Sichuan (Yanyuan).

**11. *Leptodermis hirsutiflora*** H. S. Lo, J. Trop. Subtrop. Bot. 7(1): 19. 1999.

拉萨野丁香 la sa ye ding xiang

Shrubs; branchlets terete, long branches with conspicuous internodes, short branches usually ca. 1 cm, young branches shortly pilose, glabrescent when old. Leaves sessile or petiole ca. 0.5 mm; blade oblong or elliptic, sometimes lanceolate or ovate, 7–9 mm on long branches, 2–3 mm on short branches, glabrous on both surfaces, base attenuate, apex obtuse or slightly rounded; lateral veins inconspicuous; stipules broadly triangular, ca. 1 mm, apiculate. Flowers sessile, terminal or axillary on branchlets, usually densely flowered; bracteoles 2, membranous, obovate, ca. 3.5 mm, connate below middle portion or one side free, with brown veins, densely hirsute outside, apex apiculate. Long-styled flower: calyx tube obovate, ca. 2 mm, glabrous, lobes 5, narrowly triangular-lanceolate, ca. 2 mm, densely hirsute; corolla blue, narrowly funnelform, densely hirsute outside, tube 8–9 mm, villous inside, base ca. 2.5 mm in diam., lobes 5, subovate, ca. 2.5 mm, apex incurved, with a beak ca. 0.5 mm; stamens 5, inserted at base of throat, filaments very short or absent, anthers linear, ca. 3 mm, nearly

included; style 11–12 mm, stigmas 4- or 5-lobed, lobes linear, exerted. Short-styled flowers similar to long-styled flowers; calyx tube ca. 2 mm, lobes ca. 1.4 mm, acute; corolla tube very shortly pilose outside; stamens inserted above corolla tube throat, filaments ca. 0.8 mm, anthers exerted; style ca. 5.5 mm, stigmas 3- or 4-lobed, included. Fruit ca. 5 mm, with persistent calyx lobes 2.5–3 mm, hirsute; seeds ca. 4 mm; aril reticulate, adherent to testa. Fl. Jul.

- Thickets; 4000–4100 m. Xizang.

- 1a. Calyx lobes glabrous except ciliate on margins; corolla pubescent ..... 11a. var. *ciliata*
- 1b. Calyx lobes densely hirsute; corolla densely hirsute outside, villous inside ..... 11b. var. *hirsutiflora*

**11a. *Leptodermis hirsutiflora* var. *ciliata*** H. S. Lo, J. Trop. Subtrop. Bot. 7(1): 20. 1999.

光萼野丁香 guang e ye ding xiang

Calyx lobes glabrous except ciliate on margins; corolla pubescent.

- Thickets; ca. 4100 m. SE Xizang (Gyaca).

**11b. *Leptodermis hirsutiflora* var. *hirsutiflora***

拉萨野丁香(原变种) la sa ye ding xiang (yuan bian zhong)

Calyx lobes densely hirsute; corolla densely hirsute outside, villous inside.

- Thickets on desolate mountains; ca. 4000 m. Xizang.

**12. *Leptodermis kumaonensis*** R. Parker, Indian Forester 48: 576. 1922.

吉隆野丁香 ji long ye ding xiang

Shrubs, 1–2 m tall, sometimes to 3 m tall; branchlets terete, usually purple, glandular pilose. Petiole 2–4 mm, somewhat pilose; leaf blade papery, dark gray adaxially and grayish brown or pale abaxially when dry, oblong-lanceolate or ovate-lanceolate, 3–10 × 1–2.5 cm on long branches, usually shorter than 1.5 cm on short branches, strigose pilose adaxially, pilose on midrib and lateral veins abaxially, base broadly cuneate, margins entire, usually ciliate, apex subacuminate; lateral veins 6–9 pairs, ascending in an arch, midrib compressed abaxially, veinlets dark brown, inconspicuous adaxially, scrobiculate abaxially; stipules triangular, 4–4.5 mm on upper part of branchlets, shorter on lower part, pilose outside, abruptly contracted acuminate. Flowers 3–5 fascicled on ends of lateral short branches, sessile or subsessile; bracts 2, ca. 7 mm or slightly longer, ca. 2/3 connate, free portion cuspidate, ciliate, often pilose near midrib outside. Calyx tube 3.5–4 mm; lobes 5, triangular-ovate, ca. 1.5 mm, ciliate, acute or slightly obtuse. Corolla funnelform, 13–15 mm, pilose or subglabrous outside, white villous below throat inside; lobes 5, with sinus ca. 3 mm in depth, apex obtusely 3-dentate, central portion slightly thickened, ca. 2 mm wide, margins of both sides thin, 1–1.2 mm wide, inflexed in bud. Long-styled flowers: stamens 5, inserted below throat, filaments almost absent, anthers dorsifixed, linear, ca. 3 mm, included; style ca. 9 mm, stigmas 5- or 6-lobed, lobes linear, 4–

5 mm, slightly exerted. Short-styled flowers: stamens with filaments ca. 1.5 mm, anthers slightly exerted; style ca. 4.5 mm, stigmas 5 or 6, linear, ca. 2 mm, extending to below throat. Capsule not seen, subcylindric, ca. 5.6 mm (according to record); seeds linear, covered in fibers; aril not adherent to testa.

Thickets, forest margins; 2800–3000 m. S Xizang (Gyirong) [Bhutan, N India (Uttarakhand), Nepal].

*Leptodermis parkeri* Dunn (Bull. Misc. Inform. Kew 1920: 206. 1920), described from N India, was erroneously recorded from S Xizang (Gyirong) in FRPS (71(2): 139. 1999), based on the gathering *Qinghai-Xizang Expedition 6957*, which is in fact referable to *L. kumaonensis*.

**13. *Leptodermis lanata*** H. S. Lo, J. Trop. Subtrop. Bot. 7(1): 19. 1999.

绵毛野丁香 mian mao ye ding xiang

Shrubs, 0.5–1 m tall; branches stout, terete, purplish red, subglabrous, short branches densely covered with many persistent scaly stipules at base. Petiole ca. 1 mm or leaves subsessile; leaf blade thickly papery, elliptic or obovate, sometimes oblong, 5–10 × 2–4 mm, tomentulose adaxially, grayish white lanate abaxially, base cuneate, margins revolute, apex acute; lateral veins inconspicuous; stipules long triangular, 1.5–2 mm, acuminate. Flowers sessile, usually 3 fascicled at tips of branchlets or axillary near tips of short branches; bracteoles 2, scarious, lower portion connate, longer than calyx or subequal, tomentulose, apex cuspidate. Calyx tube ca. 2 mm, subglabrous; lobes 5, oblong-lanceolate, slightly shorter than calyx tube, puberulent and shortly ciliate, shortly acuminate. Corolla pallid red, funnel-form, 12–14 mm, tomentulose outside; tube slender, decurved; lobes oblong-lanceolate or oblong-ovate, ca. 2 mm. Long-styled flowers: stamens 5, inserted below throat of corolla tube, anthers linear, included; style slightly exerted, stigmas 2-lobed, lobes filiform. Short-styled flowers similar to long styled; stamens inserted above throat of corolla tube, anthers slightly exerted. Fruit ca. 6 mm; seeds covered with reticulate aril adherent to testa. Fl. May.

• *Pinus* forests, roadsides; 2300–2500 m. NW Yunnan (Ninglang).

**14. *Leptodermis limprichtii*** H. J. P. Winkler, Repert. Spec. Nov. Regni Veg. Beih. 12: 490. 1922.

天全野丁香 tian quan ye ding xiang

Small shrubs; young branches not lignified, with 2 bands of soft hairs, old branches slender, glabrous, with gray bark. Leaves sparsely borne on young abbreviated branches, subsessile; blade oblong-lanceolate, 1–2.5 × 0.3–0.9 cm, adaxially with scattered hairs, tomentulose on midrib, abaxially glabrous, base attenuate, margins with dense bristles, apex acute, apiculate; lateral veins 3–5 pairs, inconspicuous, reticulate veins conspicuous; stipules triangular, subulate acuminate and with 2 glandular teeth near apex, another 2 glandular teeth remotely arranged or lacerate, central portion triangular, membranous-papery, villous, with transparent broad margins, not ciliate. Flowers usually 3 terminal on branchlets, subsessile, sometimes lateral flowers pedicellate, sometimes with a pair of flowers in axils of upper nodes; bracteoles thin, transparent, ovate-oblong,

2–2.5 mm, equal to calyx in length or slightly longer, 1/6–1/4 connate, shiny, 1-veined, not ciliate, long subulate-acuminate. Calyx lobes usually 5, sometimes 4, long or shortly triangular, ciliate, very apiculate. Corolla yellowish white, medium-sized; tube narrowly funnell-form, 8–9 mm, slightly curved, hispidulous outside, villous around middle inside; lobes ovate, ca. 2 mm, central portion thick and broader than transparent, wavy margins, villous at base inside, apex incurved. Stamens in long-styled flowers inserted at middle of corolla tube; filaments very short; anthers ca. 2 mm. Style usually (4 or)5-lobed.

• Thickets or open fields on hill slopes; 1000–1500 m. C Sichuan (Tianquan).

**15. *Leptodermis ludlowii*** Springate, Edinburgh J. Bot. 53: 102. 1996.

管萼野丁香 guan e ye ding xiang

*Leptodermis tubicalyx* H. S. Lo.

Shrubs, 0.6–2(–3) m tall; branchlets slender, terete, with 2 bands of hairs decurrent from base of stipules. Petiole 0.2–0.8 cm, pilose adaxially; leaf blade membranous-papery or submembranous, turning black or iron-gray when dry, ovate to ovate-oblong or broadly lanceolate, usually 1–5 × 0.5–1.5(–2) cm, subglabrous to puberulent on both surfaces, base attenuate or slightly decurrent, margins ciliate, apex acute or acuminate; lateral veins slender, (3 or)4 or 5 pairs, inconspicuous adaxially, slightly prominent abaxially; stipules subtriangular or long triangular, 1.5–2(–4) mm, glandular-denticulate or lacinate, sparsely pubescent at base, cuspidate. Inflorescences terminating short new growths, small, with uppermost pair of nodes approximate, few cymules and 3–5(–12) flowers; bract pairs leaflike and petiolate, rarely ligulate on subsidiary 1-flowered cymules; stipules as those of vegetative growth or reduced, hyaline, and lacinate. Flowers sessile; bracteole pairs ca. 1.5 mm, ca. 1/3 connate at base, lobes triangular, obtuse or subacute, glabrous, usually ciliate, mucronulate, central pairs in a cymule often more elongate and cuspidate. Calyx glabrous; hypanthium ca. 3.4 mm; tube black when dry, obovate or tubular, 1.1–1.4 mm above ovary; lobes 5, triangular, rarely orbicular, 0.7–0.8 mm, hairy or papillate in bud or around margins, rarely 6 lobes or 2 deeper clefts in tube. Corolla white, light pink, or purple, sometimes bicolored, black when dry, broadly funnell-form, with white stiff hairs at apex in bud, exterior finely mammillate, more prominently so toward apex, very rarely with few short hairs decurrent from sinuses of lobes; tube 10–11.5 mm, with long fine hairs within; lobes 5, broadly ovate-triangular, 2–4 mm, margins thin, inflexed, ca. 1 mm wide, central portion ca. 2 mm wide, apex inflexed in a beak, with few short stout smooth hairs on inner surface. Stamens 5. Long-styled flowers: filaments ca. 0.3 mm, anthers 1.7–2 mm, attached near base or rarely inserted in middle of corolla tube, included; stigmas completely exerted. Short-styled flowers: filaments 1–1.7 mm, anthers 1.9–2.7 mm, inserted below middle of corolla tube, partly exerted; stigmas immediately below anthers. Stigmas 2–4-lobed, lobes linear, 2–2.5 mm, with hairs sometimes extending onto upper style. Capsule narrow, oblong, ca. 7 mm; seeds oblong; aril reticulate, adherent to testa. Fl. Jun–Sep.

Forests; ca. 2800 m. Xizang [Bhutan, NE India (Sikkim)].

**16. *Leptodermis oblonga*** Bunge, Enum. Pl. Chin. Bor. 34. 1833.

薄皮木 bao pi mu

*Hamiltonia oblonga* (Bunge) Franchet; *Leptodermis chanetii* H. Léveillé; *L. huashanica* H. S. Lo; *L. oblonga* var. *leptophylla* H. J. P. Winkler.

Shrubs, 0.2–1 m tall or slightly taller; branches slender, gray to pale brown, puberulent, bark thin, usually peeling off when old. Petiole short, 1–3 mm; leaf blade papery or thinly leathery, lanceolate or oblong, sometimes elliptic or subovate, usually 0.7–2.5(–3) × 0.3–1(–1.7) cm, adaxially scabrid or irregularly wrinkled and sparsely strigose, abaxially subglabrous or pubescent or hispid along midrib, base attenuate or cuneate, margins revolute, apex acuminate, subacute, or obtuse; lateral veins ca. 3 pairs, inconspicuous on both surfaces; stipules broadly triangular, 1.5–2 mm, cuspidate with a stiff apiculus. Flowers sessile, usually 3 fascicled and terminal on branches, rarely axillary on upper part of branchlets; bracteoles hyaline, ovate, 3–4.5 mm, 1/2–2/3 connate, pilose outside, lobes subtriangular, with a stiff apiculus at apex, subequal to calyx in length. Calyx tube ca. 2.5 mm; lobes subovate, ca. (0.7–)1.3–1.5 mm, densely shortly ciliate, obtuse or shortly acuminate. Corolla purplish red, funnellform, (9–)11–14(–20) mm; tube slender, often curved, puberulent outside; lobes subovate, narrowly triangular, or lanceolate, 2–4 mm, apex incurved. Short-styled flowers: stamens slightly exerted, anthers linear; style included. Long-styled flowers: stamens included, anthers linear-oblong; style slightly exerted. Style with 4 or 5 linear lobes of stigma. Seed aril reticulate, free from testa. Fl. Jun–Aug, fr. Oct.

• Sunny hill slopes, roadsides, thickets. Gansu, Hebei, N Henan, Ningxia, Shaanxi, Shanxi, Sichuan [?Mongolia].

**17. *Leptodermis ordosica*** H. C. Fu & E. W. Ma, Fl. Intramongol. 5: 413. 1981.

内蒙野丁香 nei meng ye ding xiang

Small shrubs, much branched, 20–40 cm tall; branches slightly stout, often twisted, dark gray, with thin cracks; branchlets slender and straight, sometimes acicular, gray, puberulent. Petiole short or leaves subsessile; leaf blade thickly papery, oblong to elliptic, sometimes broadly elliptic, 3–10 × 2–5 mm, both surfaces subglabrous, slightly shiny adaxially, base cuneate or acuminate, margins often slightly revolute, apex acute or slightly obtuse; midrib prominent abaxially, lateral veins very inconspicuous; stipules triangular-ovate or ovate-lanceolate, slightly longer than petioles, denticulate or entire, ciliate, apiculate. Flowers subsessile, 1–3 fascicled on tips of branches or in axil near tips of branches; bracteoles 2, 1/2–2/3 connate, free part bilabiate, 3–4 mm, transparent, lobes sparsely ciliate, caudate-acuminate at apex. Calyx 2–2.5 mm; lobes 5, oblong-lanceolate, subequal to calyx tube in length or slightly shorter, ciliate, shortly acuminate. Corolla purplish red, fragrant, funnellform, 11–14 mm, puberulent outside, villous inside; lobes 4 or 5, ovate-lanceolate, ca. 3 mm. Stamens 4 or 5, inserted above throat of corolla tube; anthers linear, slightly exerted. Style ca. 1/2 length of corolla tube; stigmas 3, filiform. Fruit 3–3.5 mm; seeds surrounded by reticulate aril free from testa. Fl. and fr. Jul–Aug.

• Rock crevices; ca. 1600 m. Nei Mongol.

**18. *Leptodermis parvifolia*** Hutchinson in Sargent, Pl. Wilson. 3: 404. 1916.

瓦山野丁香 wa shan ye ding xiang

Erect or procumbent shrubs, 0.5–1(–1.5) m tall; branchlets short or slightly long, gray or reddish when young, puberulent, soon glabrescent. Petiole short; leaf blade slightly thick, spatulate-ovate or oblanceolate, sometimes subovate or elliptic, 5–10 × 2–5 mm, base attenuate, apex obtuse or subacute; lateral veins ca. 3 pairs, usually inconspicuous; stipules subulate-acuminate, ca. 1 mm, shorter than calyx, glabrous, abruptly acuminate. Calyx tube with 10 ridges, 5 ridges extending to sinus, glabrous; lobes 5, triangular-lanceolate, ca. 1.25 mm, shortly ciliate, acute. Corolla tube ca. 1.2 cm, upper portion enlarged, puberulent outside, sparsely pubescent inside; lobes 5, ovate-lanceolate, ca. 2.5 mm, with revolute margins, acute. Anthers ca. 1.25 mm, slightly exerted. Style equal to corolla tube in length, glabrous, 5-lobed, lobes slender. Capsules 4–5 mm; seed aril reticulate, adherent to testa or free at one end. Fl. Aug–Sep.

• Thickets or forest margins on sunny mountain slopes; 1500–3000 m. Sichuan.

**19. *Leptodermis pilosa*** Diels, Notes Roy. Bot. Gard. Edinburgh 5: 276. 1912.

川滇野丁香 chuan dian ye ding xiang

Shrubs, 0.7–2(–3) m tall; branches subterete, young branches tomentulose or pubescent, old branches glabrescent, with thin, lamellar, longitudinally fissured bark. Petiole 1–5 mm, ± hairy; leaf blade papery, occasionally thinly leathery, shape and size often variable, broadly ovate, ovate, oblong, elliptic, or lanceolate, 0.5–2.5 × ca. 1.5 cm, both surfaces sparsely to densely pilose or subglabrous, base cuneate or attenuate, margins usually ciliate, apex acute, obtuse, or sometimes rounded; lateral veins 3–5 pairs, slightly prominent or inconspicuous abaxially; stipules broadly triangular, pilose or tomentose, cuspidate-apiculate, usually 1–2 mm. Cymes terminal or axillary near tips of branches, usually 3(–7)-flowered; flowers sessile or shortly pedicellate; bracteoles scarious, transparent, longer than calyx, ± hairy, 2/3–3/4 connate, free portion subulate-acuminate, apiculate, veined, ciliate. Calyx tube ca. 2 mm; lobes 5, 1–1.2 mm, ciliate, obtuse or subtruncate. Corolla funnellform; tube 9–10(–13) mm, densely tomentulose outside, villous inside; lobes 5, broadly ovate, 2–2.5 mm, margins narrow and thin, inflexed, apex incurved. Stamens 5, inserted in corolla tube throat; filaments short; anthers linear, slightly exerted in short-styled flowers, included in long-styled flowers. Style usually with (3–)5 filiform stigmas, exerted in long-styled flowers, included in short-styled flowers. Fruit 4.5–5 mm; seed aril reticulate, adherent to testa. Fl. Jun, fr. Sep–Oct.

• Thickets; 600–3800 m. S Gansu, W Hubei, S Shaanxi, Sichuan, Xizang, Yunnan.

- 1a. Branches spiny ..... 19a. var. *acanthoclada*
- 1b. Branches not spiny.
  - 2a. Cymes in spikelike compound inflorescences ..... 19d. var. *spicatiformis*

- 2b. Cymes not in spikelike compound inflorescences.  
 3a. Shrubs with branches tomentulose or pubescent when young, glabrescent when old ..... 19c. var. *pilosa*  
 3b. Shrubs sparsely pilose ..... 19b. var. *glabrescens*

**19a. *Leptodermis pilosa* var. *acanthoclada*** H. S. Lo ex X. Y. Wen & Q. Lin, Acta Phytotax. Sin. 45: 410. 2007.

刺枝野丁香 ci zhi ye ding xiang

Shrubs dwarf, much branched; branches spiny.

- Thickets. W Sichuan (Xiangcheng, Xiaojin), Xizang.

**19b. *Leptodermis pilosa* var. *glabrescens*** H. J. P. Winkler, Repert. Spec. Nov. Regni Veg. 18: 160. 1922.

光叶野丁香 guang ye ye ding xiang

*Leptodermis mairei* H. Léveillé.

Shrubs sparsely pilose.

- S Sichuan (Dechang, Ningyuan, Xichang), Yunnan (Baiyanjing, Dongchuan, Lijiang).

**19c. *Leptodermis pilosa* var. *pilosa***

川滇野丁香(原变种) chuan dian ye ding xiang (yuan bian zhong)

*Leptodermis fusca* H. J. P. Winkler; *L. microphylla* (H. J. P. Winkler) H. J. P. Winkler; *L. pilosa* var. *microphylla* H. J. P. Winkler.

Shrubs with branches tomentulose or pubescent when young, glabrescent when old.

- Thickets on roadsides or on sunny slopes; 600–3800 m. W Hubei, S Shaanxi (Hanzhong, Hua Shan), Sichuan, SE Xizang, C and NW Yunnan (Kunming, Lijiang).

**19d. *Leptodermis pilosa* var. *spicatiformis*** H. S. Lo ex X. Y. Wen & Q. Lin, Acta Phytotax. Sin. 45: 411. 2007.

穗花野丁香 sui hua ye ding xiang

Leaves to 1.7 cm. Cymes often in spikelike compound inflorescences.

- Thickets on roadsides on mountain slopes; ca. 800 m. S Gansu (Huixian, Liangdang, Tianshui), SW Shaanxi (Baoji, Fengxian, Lüeyang).

**20. *Leptodermis potaninii*** Batalin, Trudy Imp. S.-Peterburgsk. Bot. Sada 14: [319]. 1898 [*potanini*].

野丁香 ye ding xiang

Shrubs, 0.5–2 m tall or taller; branches pale gray, young branches usually reddish, with 2 bands of soft hairs. Leaves sparsely arranged or slightly crowded; petiole short; blade thin, ovate or lanceolate, sometimes oblong or elliptic, both surfaces white pubescent, tomentose, subglabrous, or glabrous, base cuneate, margins entire, apex obtuse to subrounded, apiculate; lateral veins 3 or 4 pairs, prominent abaxially, reticulate veins con-

spicuous; stipules membranous, broadly triangular, acuminate, with acicular apiculus. Cymes terminal, sessile, 3-flowered, rarely reduced to 1 or 2 flowers, central flowers sessile, lateral ones pedicellate; pedicels red, with 2 bands of stiff or soft hairs; bracteoles 2, longer than calyx tube, ± connate, densely hispid or pilose outside, acute to acuminate. Calyx tube narrowly obconical, densely hispid or pilose on upper portion and calyx lobes; lobes 5 or 6, narrowly triangular, length 3 × size of width, ciliate, acute. Corolla funnelform, to 1.5 cm; tube ± pilose or subglabrous outside, densely hispid on upper portion and throat inside, limb spreading, 3 × shorter than corolla tube; lobes 5 or 6, with valvate aestivation, transparent, glabrous, margins membranous, apex rounded. Stamens 5 or 6, attached to upper portion of corolla tube, glabrous; filaments longer than anthers; anthers semi-exserted, linear-oblong. Pistils ca. 1/2 as long as corolla; ovary 3-celled; stigmas 3 or 4. Capsule 5-valvate from apex to base; valves crowned by persistent calyx lobes. Fl. May, fr. autumn and winter.

- Thickets on hill slopes or at streamsides, mountains; 800–2700 m. W Guizhou, W Hubei, S Shaanxi, W Sichuan, Yunnan.

- 1a. Leaves hairy.  
 2a. Leaves white pubescent ..... 20c. var. *potaninii*  
 2b. Leaves tomentose or long hirsute ..... 20d. var. *tomentosa*  
 1b. Leaves glabrous.  
 3a. Leaves glaucous green ..... 20b. var. *glauca*  
 3b. Leaves brown when dry ..... 20a. var. *angustifolia*

**20a. *Leptodermis potaninii* var. *angustifolia*** H. S. Lo, var. nov.

狭叶野丁香 xia ye ye ding xiang

Type: China. Yunnan: Luquan Xian (禄劝县), 5th District, Wumeng (乌蒙) town, “A-sha-hei,” 2000 m, 9 Jun 1952, P. I. Mao 1185 (holotype, KUN; isotype, KUN).

Validating Latin diagnosis: that of “*Leptodermis potanini* [sic!] Batalin var. *angustifolia* Lo” (H. S. Lo in W. C. Chen, Fl. Reipubl. Popularis Sin. 71(2): 338. 1999).

Leaves narrowly lanceolate, brown when dry, both surfaces glabrous.

- Thickets at streamsides; ca. 2000 m. NC Yunnan (Luquan).

This name was previously published by H. S. Lo (loc. cit.) but not validly so because no type was indicated (*Vienna Code*, Art. 37.1).

**20b. *Leptodermis potaninii* var. *glauca*** (Diels) H. J. P. Winkler, Repert. Spec. Nov. Regni Veg. Beih. 12: 490. 1922.

粉绿野丁香 fen lü ye ding xiang

*Leptodermis glauca* Diels, Notes Roy. Bot. Gard. Edinburgh 5: 275. 1912; *L. esquirolii* H. Léveillé; *L. motsouensis* H. Léveillé.

Leaves glaucous green abaxially. Corolla and bracteoles glabrous.

- Mountains; 800–2700 m. SW Guizhou (Xingyi), SW Sichuan, Yunnan.

**20c. *Leptodermis potaninii* var. *potaninii***野丁香(原变种) *ye ding xiang* (*yuan bian zhong*)*Leptodermis nigricans* H. J. P. Winkler.

Leaves white pubescent on both surfaces, though usually subglabrous and pale abaxially.

• Thickets on hill slopes; 800–2400 m. W Guizhou, W Hubei (Shennongjia, Xingshan), S Shaanxi (Pingli), W Sichuan (Kangding), Yunnan.

**20d. *Leptodermis potaninii* var. *tomentosa*** H. J. P. Winkler, *Repert. Spec. Nov. Regni Veg.* 18: 153. 1922.绒毛野丁香 *rong mao ye ding xiang**Leptodermis potaninii* var. *rufa* H. Winkler; *L. tongchouanensis* H. Léveillé.

Branches, leaves, stipules, bracteoles, and flowers tomentose or long hirsute.

• Mountains; ca. 2600 m. SW Sichuan, C, NE, and NW Yunnan.

**21. *Leptodermis pumila*** H. S. Lo, *J. Trop. Subtrop. Bot.* 7(1): 18. 1999.矮小野丁香 *ai xiao ye ding xiang*

Dwarf shrubs, 5–10 cm tall; taproots stout, lignose, brown; branches relatively short, pubescent, with many nodes. Leaves crowded on upper portion of short branches; petiole 1–2 mm; blade papery, elliptic or oblong, sometimes subobovate, 5–15 × 3–7 mm, pilose on midrib and lateral veins on both surfaces, base cuneate, apex acute; lateral veins 3 or 4 pairs, slightly prominent abaxially; stipules thick, triangular, 1.5–2 mm, densely pilose and ciliolate. Flowers sessile, 3 fascicled at tips of short branches; bracteoles 2, connate below middle portion, upper portion free, subtriangular, slightly shorter than or subequal to calyx in length, pilose. Calyx tube obconical, ca. 1.8 mm; lobes 5, subovate, ca. 1 mm, ciliolate, acute. Corolla pale red, funnellform; tube 1.1–1.2 cm, densely pilose outside, villous inside; lobes 5, ca. 3.5 mm, with thin and broad margins. Stamens 5, inserted below throat of corolla tube; filaments short; anthers linear, ca. 3 mm, slightly exerted. Style 7–8 mm; stigmas 3, filiform, ca. 2 mm. Fl. May.

• Grassy slopes; ca. 3000 m. NW Yunnan (Lijiang).

**22. *Leptodermis purdomii*** Hutchinson in Sargent, *Pl. Wilson.* 3: 405. 1916.甘肃野丁香 *gan su ye ding xiang*

Shrubs, 1–2 m tall; branchlets slender, puberulent when young, soon glabrescent. Leaves fascicled, papery, linear-oblancoate, 0.5–1 × 1.5–3.5 mm, both surfaces glabrous, base attenuate, margin obviously recurved, apex obtuse; nerves inconspicuous; stipules ovate, ca. 1.5 mm. Flowers sessile or subsessile, fascicled on apex of branches; bracteoles 2, opposite, transparent, membranous, ovate, ca. 1.5 mm, shorter than calyx, connate at base, subglabrous (with white acicular lines?), with carina on dorsal surface, abruptly acute at apex. Calyx tube glabrous; lobes 5, oblong-ovate, ca. 1.5 × 0.75 mm, leathery, ciliate, triangular-acute. Corolla pink, narrowly funnellform,

8–10 mm; tube slender, slightly curved, throat slightly dilated, densely pilose outside, sparsely villous inside; lobes 5, ovate-lanceolate, ca. 2 mm, sparsely pilose, subobtusate. Stamens 5, inserted in corolla tube throat; anthers linear, ca. 2 mm, included in long-styled flowers, slightly exerted in short-styled flowers. Style slender, exerted in long-styled flowers, reaching middle of tube in short-styled flowers; stigmas 5-lobed, lobes linear. Capsules ca. 5 mm; seed aril reticulate, adherent to testa. Fl. Jul–Aug, fr. Sep–Oct.

• Mountain slopes; 800–1000 m. S Gansu, N Sichuan (Songpan).

**23. *Leptodermis rehderiana*** H. J. P. Winkler, *Repert. Spec. Nov. Regni Veg.* 18: 157. 1922.白毛野丁香 *bai mao ye ding xiang*

Shrubs, 1–2 m tall, very much branched, white villous or pilose; branchlets slender. Petiole to 1 cm; leaf blade papery, brownish gray when dry, lanceolate-oblong or ovate-oblong, sometimes subovate, 1–4 × ca. 2 cm, base attenuate, apex acute or shortly acuminate, sometimes obtuse; lateral veins 2–5 pairs, slightly prominent abaxially; stipules stiff, ca. 2 mm, acicular-acuminate on lower portion, shortly acuminate on upper portion. Flowers terminal on foliate branches, 5–7 flowers arranged in a line; central flowers sessile, lateral ones conspicuously pedicellate, branchlets usually with 2 or 3 flowers axillary on upper 4 or 5 nodes, inflorescence-like on lower 1 or 2 nodes, with peduncle; bracteoles transparent, oblong, 2.5–3 mm, slightly longer than calyx, ca. 2/3 connate, upper portion very shortly pilose, other parts glabrous, veined, subulate-acuminate. Calyx 2.5–2.8 mm; lobes 5, very short, ciliate, with longitudinal veins. Corolla tube very narrowly funnellform, 12–13 mm, slightly curved, densely shortly tomentose outside; lobes 5, subovate, ca. 2 mm, central portion and narrow margins not differentiated conspicuously, apex incurved. Stamens of short-styled flowers slightly exerted; filaments inserted at 1/4–1/3 of anthers, free portion very short. Stigmas 5-lobed. Capsules black, 6–7 mm; seed aril reticulate, adherent to testa. Fl. Sep, fr. Oct–Nov.

• Thickets, jungles; 1600–2400 m. NW Yunnan (Zhongdian).

**24. *Leptodermis scabrida*** J. D. Hooker, *Fl. Brit. India* 3: 199. 1881.糙叶野丁香 *cao ye ye ding xiang*

Shrubs, 1–1.5 m tall; branches stout, brown or dark gray, short branches often with dense persistent scaly stipules, pilose. Petiole short or leaves subsessile; leaf blade oblong-lanceolate or oblong, sometimes narrowly lanceolate, 1–3(–4) × 4–10 mm, both surfaces ?strigose or only midrib and lateral veins hairy abaxially, base cuneate or decurrent, apex acute to acuminate; midrib prominent abaxially; lateral veins 3 or 4 pairs, inconspicuous; stipules subtriangular, pilose, with a long and excurved stiff apiculus. Flowers subsessile, 3–5 terminal or axillary near tips of branches; bracteoles transparent, 3–4 mm, pilose, ca. 2/3 connate, free portion triangular-ovate, with a stiff apiculus at apex. Calyx tube ca. 2 mm; lobes 0.5–0.7 mm, width greater than length or subequal, densely ciliate, obtuse. Corolla white, funnellform, 9–19 mm, pilose outside; lobes 5, sublanceolate, 2–2.5 mm. Short-styled flowers with stamens

inserted below throat of corolla tube, anthers linear, included; style slightly exerted, stigmas 3-lobed, filiform, excurved. Capsule 5–6 mm; seed aril free from testa (according to literature). Fl. Jun.

Forests, hill slopes; 2400–2600 m. S Xizang (Nyalam, Zayü) [NE India (Assam)].

**25. *Leptodermis schneideri*** H. J. P. Winkler, *Repert. Spec. Nov. Regni Veg.* 18: 156. 1922.

纤枝野丁香 xian zhi ye ding xiang

*Leptodermis schneideri* var. *hutchinsonii* H. J. P. Winkler.

Shrubs, 0.2–1.3 m, branches slender; young branches tomentulose, soon glabrescent, old branches with gray longitudinally fissured bark. Leaves sparsely arranged on long branches, very crowded on very short branches in axils of long branches, appearing as if leaves whorled; petiole very short or leaves sessile; blade oblong or ovate, 4–9 × 1.25–2 mm, glabrous on both surfaces, base attenuate, apex acute or slightly obtuse or apiculate; midrib impressed adaxially and prominent abaxially, lateral veins inconspicuous; stipules membranous-leathery, small, ca. 1 mm, pilose and ciliate, upper portion triangular, lower part acicular acuminate, with 2 callose nerves near margins extending to apex. Flowers terminal on lateral foliate branches, upper 2 or 3 nodes with 1–3 flowers axillary; peduncles present or almost absent; bracteoles transparent, oblong, ca. 2 mm, slightly longer than calyx, connate to or above middle portion, margins of upper portion hairy, apex rounded, apiculate. Calyx lobes 5, length slightly greater than width, ciliate, rounded. Corolla small; tube narrowly funnelform, ca. 5 mm, ± curved, covered with conical woolly hairs outside, densely covered with long hairs on throat inside, glabrous at base; lobes oblong, ca. 2 mm, covered with short papilla outside, villous at base inside, with thin, soft, narrow margins, apex incurved. Stamens inserted in throat of corolla tube; long-styled flowers with filaments short, anthers included; short-styled flowers with filaments long, anther exerted. Stigmas 5-lobed, conspicuously exerted in long-styled flowers, extending below throat in short-styled flowers. Capsules ca. 4 mm; seed aril adherent to testa.

• Sichuan, Xizang, Yunnan.

**26. *Leptodermis scissa*** H. J. P. Winkler in Handel-Mazzetti, *Symb. Sin.* 7: 1024. 1936.

撕裂野丁香 si lie ye ding xiang

Shrubs, 20–50 cm tall, occasionally to 1.5 m tall; branchlets gray or brown, tomentulose. Leaves crowded on branchlets, blade papery, ± grayish when dry, oblong-ovate or broadly ovate, 5–8 × 2.5–4 mm on lower branches, 15–23 × 7–13 mm on upper branches, adaxially densely scabrid on midvein, slightly scabrid on lateral veins and margins, abaxially glabrous, base attenuate, apex apiculate; lateral veins 3 or 4 pairs, straight; stipules submembranous, tomentulose outside, with glandular appendages inside, long triangular on lower portion, shortly triangular on upper portion, glandular acuminate upward, sometimes with 1 or 2 glandular teeth, with 2 veins confluent at apex, uppermost stipules short and broad, abruptly acuminate, without veins. Flowers often 3 terminal on short

branches, with short pedicels or longer at each side, or 1–3 flowers axillary in axils of leaves at nodes; bracteoles ovate, 2.8–3 mm, free almost to base, midrib nearly brownish, shortly hairy, other portions subglabrous, margins imbricate, ciliate, apex acuminate, with apiculus almost as long as calyx or shorter. Calyx 3–3.2 mm; lobes 5, triangular, usually ± scattered pilose, ciliate. Corolla tube funnelform, ca. 11 mm, slightly curved, glabrous or puberulent outside, long villous inside, glabrous near base; lobes ovate-orbicular, ca. 2 mm, glabrous outside. Stamens 5 in short-styled flowers, inserted in throat of corolla tube; anthers linear, ± semi-exserted, covered with glandular long soft hairs inside. Style 5-lobed, included, glabrous. Fruit ovoid, ca. 4 mm; seed aril conspicuously free from testa. Fl. Jul–Aug, fr. Oct.

• Thickets; 1500–2500 m. Sichuan, Yunnan.

**27. *Leptodermis tomentella*** H. J. P. Winkler, *Repert. Spec. Nov. Regni Veg.* 18: 159. 1922.

蒙自野丁香 meng zi ye ding xiang

Shrubs; stems, branches, and both surfaces of leaves tomentulose; branchlets stout, terete, upper branchlets short, lower branchlets longer, secondary branchlets very short. Petiole short and thick; leaf blade thickly papery, brownish when dry, ovate or elliptic, 5–19 × 2.5–10 mm, base broadly cuneate, apex acute, with a short stiff apiculus; lateral veins 2 or 3 (or 4) pairs, inconspicuous adaxially, slightly prominent abaxially; stipules triangular, 1–1.5 mm, with stiff acicular apiculus. Flowers 3–7 fascicled at tips of branchlets, subsessile; bracteoles ovate, ca. 3 mm, ca. 1/3 connate, tomentose, with acicular apiculus slightly shorter than calyx lobes. Calyx tubes black when dry; lobes pale brown, ovate-oblong, ca. 1.5 mm, ciliate, slightly obtuse. Corolla purple or white, funnelform, 1.2–1.3 cm, tomentose outside, throat villous; lobes with margins broad, soft and thin. Stamens 5, inserted in throat of corolla tube; filaments very short; anthers linear, ca. 2.5 mm. Style exerted; stigmas 5-lobed, lobes linear. Capsules ca. 5 mm; seed aril reticulate, adherent to testa. Fl. May–Jun, fr. Sep.

• Mountain slopes; 1500–2000 m. C and S Yunnan (Chengjiang, Mengzi).

**28. *Leptodermis umbellata*** Batalin, *Trudy Imp. S.-Peterburgsk. Bot. Sada* 13: 374. 1894.

伞花野丁香 san hua ye ding xiang

Shrubs, to 2 m, much branched; young branches, peduncles, and pedicels covered with white stiff hairs. Leaves sparsely arranged; petiole usually 4–6 mm; blade papery, black adaxially and usually pale or brownish abaxially when dry, elliptic or oblong, sometimes obovate, 10–35 × 5–16 mm, both surfaces shortly hispid, base cuneate, attenuate, apex acute or shortly acuminate; lateral veins sparse, usually 2 or 3 pairs, inconspicuous; stipules broadly triangular, hispid. Flowers with pedicels straight, 3–9 mm, arranged in umbelliform groups, rarely 1–3 flowers axillary; peduncles to 1 cm or longer; bracteoles ca. 3 mm, subequal to calyx tube in length or slightly shorter, ca. 2/3 connate, upper portion bilabiate dehiscent, hispid. Calyx lobes suborbicular, width slightly greater than length, ciliate, apex slightly rounded or subtruncate. Corolla purple, narrowly

funnelform, ca. 12 cm, densely hispid outside, slightly hairy inside; lobes 5, oblong, ca. 3 mm, with incurved abrupt apiculus. Long-styled flowers: stamens inserted above throat of corolla tube, filaments ca. 1.5 mm, anthers linear, ca. 2.5 mm, exerted. Short-styled flowers: stigmas 5-lobed, lobes linear, included. Capsule 4–5 mm; seed aril reticulate, free from testa or adnate with testa on ventral side. Fl. Sep–Oct.

• Hill slopes; 500–700 m. S Gansu (Bikou, Wenxian), N Sichuan (Qingchuan).

**29. *Leptodermis velutiniflora*** H. S. Lo, J. Trop. Subtrop. Bot. 7(1): 17. 1999.

毛花野丁香 mao hua ye ding xiang

Shrubs, 0.5–1 m tall; branchlets terete, slender and firm, densely pubescent. Petiole 3–6 mm, densely pilose; leaf blade papery or thinly papery, when dry turning black adaxially, pale brown abaxially, elliptic to oblong or ovate to lanceolate, 10–40 × 5–20 mm, scattered with sparse appressed pubescence adaxially, villous on midrib and lateral veins abaxially, base cuneate to broadly cuneate, apex acute or acuminate; lateral veins 4 or 5 pairs, slender, conspicuous abaxially; stipules ca. 1.5 mm, broadly triangular at base, sometimes with stipitate glands on margins, with a stiff acicular apiculus at apex. Short-styled flowers 2–5 fascicled on tips or axillary on upper portion of branchlets; pedicels usually 2–6 mm, sometimes up to 8 mm, pilose; bracteoles 2, small, ca. 1.2 mm, ca. 1/3 of lower portion connate, lobes triangular, ca. 7 mm, pubescent. Calyx tube ca. 2 mm, glabrous; lobes 5, triangular, ca. 0.4 mm, margins hirsute, apex acute. Corolla funnelform or broadly funnelform, ca. 0.4 mm, brown tomentose outside, white villous on throat inside, or glabrous on both sides; lobes 5, triangular-oblate, 3–3.5 × ca. 4 mm, margins thin and broad, apex obtuse. Stamens 5, inserted in throat of corolla tube; filaments ca. 2 mm; anthers ca. 2.5 mm, exerted. Style extended to middle of corolla tube; stigmas 4-lobed, lobes 0.5–0.6 mm. Fl. May–Jun.

• Forests, forest margins; 2800–3100 m. Sichuan, SE Xizang, NW Yunnan.

- 1a. Leaves thinly papery; corolla glabrous ..... 29a. var. *tenera*  
 1b. Leaves papery; corolla brown  
 tomentose outside, white villous  
 on throat inside ..... 29b. var. *velutiniflora*

**29a. *Leptodermis velutiniflora* var. *tenera*** H. S. Lo, J. Trop. Subtrop. Bot. 7(1): 17. 1999.

薄叶野丁香 bao ye ye ding xiang

Leaves thinly papery. Corolla glabrous. Fl. May–Jun, fr. Aug.

• Forests, forest margins; 2800–3100 m. SW Sichuan (Muli, Yan-yuan), SE Xizang (Bomi, Mainling, Nyingchi), NW Yunnan (Binchuan, Weixi).

**29b. *Leptodermis velutiniflora* var. *velutiniflora***

毛花野丁香(原变种) mao hua ye ding xiang (yuan bian zhong)

Leaves papery. Corolla brown tomentose outside, white villous on throat inside.

• Sichuan.

**30. *Leptodermis vestita*** Hemsley, J. Linn. Soc., Bot. 23: 390. 1888.

广东野丁香 guang dong ye ding xiang

*Leptodermis ovata* H. J. P. Winkler.

Shrubs, with a few ascending branches, to 0.6 m tall; young branches and leaves slightly to densely squarrose hirsute, glabrescent. Petiole stout, 0.4–0.7 cm, slightly to densely hairy, sometimes leaves sessile; leaf blade subleathery, iron-gray abaxially when dry, ovate, ovate-oblong, elliptic, or sometimes sub-orbicular, 1.5–4 × 1–2.2 cm, adaxially glabrous or ± hirsutulous on midrib, abaxially hirsutulous on midrib and lateral veins or glabrous, base attenuate or cuneate, margin slightly revolute, apex shortly acuminate, acute, or obtuse; lateral veins 4–7 pairs, together with veinlets adaxially inconspicuous, abaxially conspicuous; stipules broadly triangular, 0.8–1.5 mm, sometimes inconspicuous, apex apiculate. Flowers 3–7 fascicled, terminal or in axils of upper 3–6 pairs of leaves, subsessile or pedicel 0.3–2.6 mm; bracteoles rigid, hyaline, oblong, 2.5–3.5 mm, longer than calyx or subequal at anthesis, ca. 2/3 portion connate, veined, subulate-acuminate. Calyx tube 1.3–3.3 mm, glabrous or slightly hairy outside; lobes 5, ca. 0.5 mm, width greater than length, longitudinally veined, margins slightly imbricate, ciliate, apex subrounded. Corolla white, purple, or red, narrowly funnelform, ca. 1.5 cm, slightly curved, tomentose to sparsely pubescent; lobes 5, oblong, 1.4–1.8 mm, central portion thicker than narrow margins, apex incurved. Stamens 5. Short-styled flowers: stamens inserted above throat of corolla tube, filaments 1.3–3.2 mm, anthers 1.2–2 mm, slightly exerted; style 6.5–9.7 mm, stigma 0.3–1.8 mm, 3–6-lobed. Long-styled flowers: stamens inserted at throat of corolla tube, filaments ca. 0.7 mm, anthers 1.6–2 mm, included; ovary 5-celled, ovule 1 per cell; style 11.2–15.3 mm, stigma 0.6–1.8 mm, 3–5-lobed, slightly exerted. Capsule obovoid, 5.2–7.6 mm; seeds narrowly ellipsoid to ellipsoid or narrowly obovoid to obovoid, 3.3–5.5 mm; aril reticulate, free from testa. Fl. Jun–Dec, fr. Aug–Jan.

• N Guangdong (Lianxian, Ruyuan), Guangxi.

**31. *Leptodermis wilsonii*** Diels, Notes Roy. Bot. Gard. Edinburgh 5: 275. 1912.

大果野丁香 da guo ye ding xiang

Shrubs, usually 0.5–1 m tall; branches slightly stout, with brown or grayish white bark and 2 longitudinal grooves, grooves pilose. Petiole 2–4 mm or slightly longer; leaf blade papery, black or dark gray adaxially when dry, light brown abaxially, ovate or ovate-elliptic, sometimes lanceolate or oblong-lanceolate, 1–3.5(–3.9) × 0.5–1.8(–2) cm, glabrous on both surfaces except midrib and margins pilose adaxially, slightly smooth, base broadly cuneate, apex acute or obtuse; lateral veins 3 or 4 pairs, inconspicuous adaxially, not or slightly prominent abaxially; stipules long triangular, ca. 2 mm, with stiff apiculus, margins usually glandular. Flowers subsessile, usually 3 flowers terminal on branches, occasionally axillary near tips of branches; bracteoles 2, subscarios, lanceolate or ovate-triangular, 2–2.5 mm, usually slightly shorter than

sinus of calyx limb, glabrous or pilose, acuminate. Calyx black when dry; tube ca. 2.5 mm; lobes narrowly triangular, ca. 1.8 mm, shortly ciliate, acuminate, slightly spreading. Corolla white or pallid red, fragrant, funnelliform, smooth outside, glabrous; tube 12–14 mm, villous inside; lobes spreading, suborbicular, 4–6 mm in diam., central portion relatively thick, margins broad and thin, erose, apex callose acute. Stamens 5, inserted in throat of corolla tube in short-styled flowers; filaments ca. 3 mm; anthers linear, ca. 4 mm, slightly exerted. Style dark brown or black when dry, linear, 7–8 mm, glabrous. Seed aril reticulate, adherent to testa. Fl. Jun, fr. Oct–Nov.

• Jungles, thickets; 1800–3000 m. W Sichuan (Shimian), NW Yunnan (Dali, Heqing, Lijiang).

**32. *Leptodermis xizangensis*** H. S. Lo, J. Trop. Subtrop. Bot. 7(1): 16. 1999.

西藏野丁香 xi zang ye ding xiang

Shrubs, 50–80 cm tall; branches terete, slightly stout, purplish black, glabrous or pubescent, short branch usually ca. 1 cm, with dense nodes and short internodes. Leaves arranged on short branches; petiole short or leaves subsessile; blade thickly papery or slightly fleshy, black adaxially and pale brown abaxially when dry, ovate-elliptic to lanceolate-oblong, 0.7–1.2 × 4–6 mm, both surfaces glabrous except margin ciliate, base broadly cuneate, apex acute or obtuse; midrib conspicuous abaxially, lateral veins sparse, inconspicuous; stipules long triangular, 2–2.5 mm, cuspidate-caudate, sometimes both sides adnate to petiole. Flowers sessile, usually 3 flowers terminal on tips of short branches; bracteoles 2, scarious, transparent, ca. 4.5 mm, connate to middle portion, apex with an acicular apiculus. Calyx tube ca. 2.5 mm; lobes 5, triangular, ca. 0.6 mm, densely ciliate, acute. Corolla purple, turning black when dry, broadly funnelliform, ca. 1.6 mm, glabrous outside, throat expanded, ca. 5 mm in diam., sparsely villous or subglabrous inside; lobes 5, broadly ovate-suborbicular, ca. 4 mm, apex shallowly 3-lobed or cuspidate, apiculus obtuse. Stamens 5, inserted below corolla tube throat; filaments very short; anthers lanceolate-linear, ca. 2 mm. Style ca. 12 mm; stigmas 3-lobed, ca. 2 mm, linear.

• Thickets; ca. 3400 m. S Xizang (Gyirong).

**33. *Leptodermis yangshuoensis*** Tao Chen, *sp. nov.*

阳朔野丁香 yang shuo ye ding xiang

Type: China. Guangxi: Yangshuo Xian (阳朔县), Bilianfeng (碧莲峰), between rocks at roadsides or forest margins on limestone hilltop, ca. 300 m, 16 Sep 1999, T. Chen & Y. K. Li 990916001 (holotype, SZG; isotypes, A, MO).

*Haec species* *Leptodermidi vestitae Hemsley similis, sed ab ea inflorescentiis ad ramos hornotinos dispositis terminalibus vel raro in axillis foliorum superiorum, pedunculo elongato atque pedicello manifesto usque ad 8 mm longo differt.*

Paratype: China. Guangxi: Yangshuo Xian (阳朔县), Matang (马塘), Longtouzhai (龙头寨), 380 m, on limestone hill, 20 Oct 1963, Z. Z. Chen (陈照宙) 53104 (IBK – bar code 00100138).

Shrubs to 1 m high, with raphides distinctly present on

leaves, stipules, bracts, bracteoles, calyx, and corolla. Current year's branches subquadrangular, glabrous, ?straw-yellow when dry; previous year's branches with grayish white bark peeling off; old branches dark brown. Leaves opposite and sometimes in clusters on lateral short branches; petiole to 12 mm, grooved adaxially; blade subleathery, slightly shiny when dry, adaxially dark green, abaxially pale green, ovate to ovate-oblong, to 50 × 25 mm, glabrous on both surfaces, base obtuse, slightly decurrent to petiole, margins entire, slightly ciliate near apex, apex acute or shortly acuminate; midrib impressed adaxially when dry, lateral veins 3–6 pairs, slender, arcuate ascending, confluent along leaf margin, adaxially depressed or slightly impressed, abaxially prominent, veinlets abaxially conspicuous; stipules broadly triangular, apiculate. Inflorescences thyrsoid, borne on current year's branches, terminal or rarely in axils of upper leaves; peduncle purplish brown, elongate, slightly angular when dry, slender or slightly stout; bracts leaflike to subulate. Flowers (1–)3–5 fascicled, terminal on ultimate branches of inflorescence; pedicels purplish brown, to 8 mm; bracteoles connate, membranous, ca. 3 mm, equal to or slightly longer than calyx, distinctly veined, with raphides; lobes 2, triangular, ca. 1.2 mm, slightly bilobed at apex. Calyx with hypanthium ca. 1.5 mm; tube ca. 0.3 mm; lobes 5, ovate-oblong, ca. 1.2 mm, white ciliate. Corolla white or pale purple, narrowly funnelliform, ca. 12 mm; tube narrow, 9–10 mm, densely hairy at throat, with hairs becoming sparse toward base; lobes 5, ovate-triangular, ca. 3 mm, reticulately veined. Stamens 5, inserted at throat; filaments very short; anthers ca. 1.5 mm. Ovary 5-celled, each cell with 1 ovule, basal; style slender; stigma 5-lobed, lobes linear, slender, revolute, adaxially hairy. Fruit a capsule, ovoid, ca. 4 mm, septicidally dehiscent into 5 valves, 5-seeded; valves persistent, with persistent calyx lobes at apex; seeds black, ca. 2.5 mm; aril reticulate, free. Fl. Aug–Oct, fr. Oct–Nov.

• Limestone hills; 300–400 m. NE Guangxi (Yangshuo).

**34. *Leptodermis yui*** H. S. Lo, J. Trop. Subtrop. Bot. 7(1): 15. 1999.

德浚野丁香 de jun ye ding xiang

Shrubs, 0.5–1.5 m tall; branches and branchlets slender, old branches purplish red, glabrous, young branches with short, soft hairs in 2 bands. Leaves sparsely arranged; petiole 0.3–0.6 cm; blade membranous, adaxially dark brown and abaxially slightly pale when dry, broadly ovate to lanceolate, 1.5–4.5 × 0.7–2 cm, adaxially dispersedly strigose, abaxially glabrous or with sparse stiff hairs on midrib, base broadly cuneate or cuneate, margins fimbriate ciliate, apex obtuse or subacute, sometimes rounded; midrib very compressed abaxially, lateral veins slender, 4 or 5 pairs, conspicuous abaxially; stipules slightly short on upper part of branchlets, ca. 1 mm, apex lacerate, glandular, triangular on lower portion of branchlets, ca. 2 mm, margins with glandular hairs. Flowers 1–3 terminal, sessile; bracteoles 2, base connate (ca. 1 mm), free portion lanceolate or ensiform-lanceolate, ca. 2 mm, sparsely hispid, margins sometimes glandular. Calyx tube ca. 2 mm; lobes 5, narrowly triangular, longer than tube, hispid ciliate, acuminate. Corolla purple, broadly funnelliform, apex with tufted long soft hairs; tube

9–10 mm, glabrous outside, covered with white long soft hairs inside; lobes 5, broad, obovate, ca. 5 mm wide, margin crisped, both surfaces villous, apex shallowly 3-lobed. Stamens 5, inserted below throat of corolla tube; filaments short; anthers ob-

long-linear, ca. 2 mm, included. Style slightly exerted, stigmas 2-lobed, lobes filiform.

- Forest margins; ca. 2500 m. SW Sichuan (Muli).

#### 45. LEPTOMISCHUS Drake, Bull. Mus. Hist. Nat. (Paris) 1: 117. 1895.

报春茜属 bao chun qian shu

Chen Tao (陈涛); Charlotte M. Taylor

*Indopolysolenia* Bennet; *Polysolen* Rauschert, nom. illeg. superfl.; *Polysolenia* J. D. Hooker (1873), not Ehrenberg ex Kützing (1849) [Fungi].

Perennial herbs or subshrubs, unarmed, presumably rather succulent. Raphides present. Leaves opposite, sometimes crowded or rosulate, perhaps without domatia, with margins sometimes crisped and/or reportedly serrulate; stipules persistent to deciduous, interpetiolar or shortly united around stem, triangular to suborbicular (*Leptomischus funingensis*), often well developed and veined, entire or 2- or 3-lobed (*L. wallichii*), glabrous or glabrescent adaxially. Inflorescences terminal and apparently sometimes pseudoaxillary, capitate to congested-cymose or umbelliform, several to many flowered, subsessile to pedunculate, bracteate with bracts often well developed to involucre. Flowers sessile to pedicellate, bisexual, distylous and sometimes markedly dimorphic. Calyx limb 5-lobed. Corolla white or yellow, funnelform, salverform, or sometimes inflated, inside pubescent in upper part or most of tube; lobes 5, valvate in bud. Stamens 5, inserted below middle of corolla tube in long-styled flowers, inserted in corolla throat in short-styled flowers, included or partially exerted; filaments usually short; anthers basifixed or perhaps dorsifixed near base. Ovary 2-celled, ovules numerous in each cell borne on stipitate placentas apparently near base of septum; stigma 2-lobed, included or exerted. Fruit capsular, subglobose, dehiscent through apical portion or operculum inside calyx limb, perhaps papery, with septum reportedly mostly disintegrating leaving 1 incomplete cell; seeds numerous, small, reticulate or areolate.

Seven species: S China, NE India, Myanmar, Vietnam; five species (three endemic) in China.

*Leptomischus* seems to be similar to *Keenania* and *Mouretia*; all of these genera are rather poorly known. Several authors (e.g., Deb & Rout, Kew Bull. 45(2): 339–341. 1990; H. S. Lo in FRPS 71(1): 184–189. 1999) have reported marked floral dimorphism in species of *Leptomischus*.

- 1a. Leaf blade shallowly cordate or subtruncate at base; stems well developed with leaves distributed along them; calyx with multicellular long trichomes ..... 3. *L. guangxiensis*  
 1b. Leaf blade obtuse to acute at base; stems short to well developed with leaves distributed along them or congested at ends; calyx glabrous or with unicellular or multicellular trichomes.  
 2a. Flowers smaller, corolla 6–6.5 mm; calyx and corolla glabrous outside ..... 4. *L. parviflorus*  
 2b. Flowers larger, corolla longer than 10 mm; calyx and corolla glabrous to variously pubescent outside.  
 3a. Stems short, with leaves crowded and rosulate; calyx and corolla unicellular pilosulous outside ..... 5. *L. primuloides*  
 3b. Stems developed, with leaves distributed along them; calyx and corolla densely multicellular villous, -tomentose, or -pilosulous outside.  
 4a. Stipules ovate to lanceolate, 8–9 mm ..... 1. *L. erianthus*  
 4b. Stipules suborbicular, 4–5 mm ..... 2. *L. funingensis*

**1. *Leptomischus erianthus*** H. S. Lo, Bull. Bot. Res., Harbin 18: 277. 1998.

毛花报春茜 mao hua bao chun qian

Herbs, weak to erect, 1–2 m tall; stems quadrangular, densely hirtellous. Leaves opposite, distributed along stems; petiole usually 0.5–1.5 cm, densely hirtellous; blade drying papery, black adaxially, dark brown abaxially, narrowly elliptic to lanceolate-elliptic, 4–12 × 1.5–4 cm, adaxially sparsely strigose to glabrescent, abaxially glabrescent except multicellular villous along principal veins, base cuneate, margins densely multicellular-ciliate, apex acuminate or caudate-cuspidate; secondary veins 9–12 pairs; stipules persistent, ovate or lanceolate, 8–9 mm, densely striate veined. Inflorescences terminal, subcapitate, densely multicellular villous with trichomes drying brown; peduncle shorter than 1 cm. Flowers subsessile. Calyx multicellular villous; hypanthium portion obconic, ca. 1.5 mm; limb lobed for ca. 1/2; lobes narrowly triangular, ca. 4 mm, acute.

Corolla white, tubular, densely multicellular tomentose or -pilosulous outside with trichomes drying brown; tube 15–16 cm, inside upper part white villous; lobes triangular-lanceolate, 4–5 mm, acute. Capsules obconic, 5–6 mm, with persistent calyx lobes to 3 mm. Fl. May, fr. Jul.

- Dense forests in moist valleys; 1500–1700 m. Yunnan.

**2. *Leptomischus funingensis*** H. S. Lo, Bull. Bot. Res., Harbin 18: 278. 1998.

富宁报春茜 fu ning bao chun qian

Herbs, unbranched; stems terete to quadrangular, pilosulous. Leaves opposite, distributed along stems; petiole 1–3 cm; blade drying black-brown, ovate, narrowly elliptic, or rarely obovate, 8–15 × 2.5–4.5 cm, adaxially glabrescent to pilose, abaxially villous, base cuneate, margins entire or serrulate-ciliate, apex acuminate; secondary veins 5–7(or 8) pairs; stipules suborbicular, 4–5 mm, usually reflexed, villous abaxially

and marginally. Inflorescences terminal, cymose, densely many flowered; peduncles shorter than 1 cm; pedicels 3–3.5 mm. Flowers pedicellate. Calyx densely multicellular villous; hypanthium portion obconic, 3.5–4 mm; limb deeply lobed; lobes subtriangular, ca. 1.5 mm, obtuse. Corolla white or bright yellow, tubular-salverform, densely multicellular villous outside; tube 14–16 mm, white villous inside; lobes subelliptic, 4–6 mm, obtuse. Capsules obconic or subglobose, pilose, weakly shiny. Fl. summer.

- Streamsides in dense forests; ca. 1000 m. Yunnan (Funing).

**3. *Leptomischus guangxiensis*** H. S. Lo, Bull. Bot. Res., Harbin 18: 278. 1998.

心叶报春茜 xin ye bao chun qian

Herbs; stems densely multicellular tomentose with trichomes drying grayish brown. Leaves opposite, distributed along stems; petiole 2.5–3.5 cm, densely pilosulous; blade drying papery and brownish gray adaxially, ovate or oblong-ovate, 5–8.5 × 2.5–4.5 cm, sparsely strigose adaxially, pilosulous except multicellular tomentose along midrib abaxially, base shallowly cordate to subtruncate, margins entire, apex acute to obtuse; secondary veins 5–7 pairs; stipules subovate, 7–9 mm, villous. Inflorescences terminal, cymose, densely multicellular tomentose; peduncle ca. 1 cm. Flowers not seen. Capsules obconic, multicellular villous, together with persistent calyx lobes 9–10 mm. Fl. May, fr. Apr, Jan.

- Shady grasslands near water. Guangxi.

**4. *Leptomischus parviflorus*** H. S. Lo, Bull. Bot. Res., Harbin 6(4): 49. 1986.

小花报春茜 xiao hua bao chun qian

Herbs, 10–30 m tall; stems terete to 4-angled, densely villosulous. Leaves opposite, distributed along stems or in clusters near stem apices; petiole 4–10(–20) mm, puberulent to villosulous; blade drying papery, dark green adaxially, greenish yellow abaxially, elliptic, narrowly elliptic, or oblanceolate, 4–14 × 1–4 cm, glabrous adaxially, glabrous on lamina and densely puberulent to villosulous on veins abaxially, base acute to obtuse, margins entire, apex obtuse to shortly acuminate; secondary veins 12–16 pairs; stipules persistent, rather leaflike, ovate to ligulate,

4–14 mm, veined, glabrescent, acute to obtuse. Inflorescences terminal, capitate, several flowered, puberulent to glabrous; peduncle 0.4–5 cm; bracts obovate to oblong-oblanceolate or narrowly oblanceolate, 3–10 mm, entire or sparsely ciliate. Flowers sessile. Calyx glabrous; hypanthium portion obovoid, smooth to 5-ribbed, ca. 1.5 mm; limb lobed for ca. 1/2; lobes ovate to ligulate, 1–1.2 mm, obtuse. Corolla white, funnelliform, 6–6.5 mm, glabrous outside; tube densely white villous in throat; lobes subtriangular, margins thickened, apex rostrate. Capsules subglobose, 2.5–3.5 × 3–4.5 mm, glabrous; seeds 0.2–0.4 mm. Fl. Jul–Aug, fr. Aug.

Dense forests. Hainan (Sanya), Yunnan (Hekou) [N Vietnam].

**5. *Leptomischus primuloides*** Drake, Bull. Mus. Hist. Nat. (Paris) 1: 117. 1895.

报春茜 bao chun qian

*Indopolysolenia burmanica* Deb & Rout.

Perennial herbs or subshrubs, 10–30 cm tall; stems stout, subterete to quadrangular, pilosulous. Leaves opposite, crowded and rosulate; petiole 0.4–4 cm, pilose; blade drying papery, obovate, broadly obovate, or elliptic, (7–)15–25 × (2–)5–10 cm, adaxially glabrous, abaxially glabrescent except puberulent along principal veins, base cuneate to acute, margins entire, apex acute or obtuse; secondary veins 14–19 pairs; stipules deciduous, elliptic, lanceolate, or ovate, 6–18 mm, pilosulous, acute or acuminate. Inflorescences terminal and/or pseudoaxillary in uppermost axils, capitate to subcapitate, several flowered, glabrescent; peduncle 2.5–12 cm; heads 2–5 cm wide; bracts ovate, 6–14 mm, pilose, acuminate or acute. Flowers sessile. Calyx unicellular pilosulous; hypanthium portion ellipsoid-obovoid, 1–1.5 mm; limb lobed for ca. 1/2; lobes lanceolate, (1–)2.5(–4) mm, ciliate, acute or acuminate. Corolla funnelliform or tubular to inflated, outside pilosulous; tube 16–18(–25) mm, villous in throat; lobes triangular, ca. 2 mm, acute or obtuse. Capsules obovoid, ca. 3 × 4 mm. Fl. early winter.

Forests; [ca. 200 m in Myanmar]. Yunnan (Hekou) [Myanmar, Vietnam].

The measurements above include some from the protologue of *Indopolysolenia burmanica*, which was placed by Lo (Acta Phytotax. Sin. 31: 275. 1993) in synonymy with *Leptomischus primuloides*.

#### 46. **LEPTUNIS** Steven, Bull. Soc. Imp. Naturalistes Moscou 29(2): 366. 1857.

乐土草属 le tu cao shu

Chen Tao (陈涛); Friedrich Ehrendorfer

Herbs, annual, slender. Raphides present. Stems subterete. Leaves and leaflike stipules in whorls of 8–16, sessile, linear to filiform, without domatia. Inflorescences terminal, thyrsoid, below with dichasial and above with monochasial cymes, few flowered when young but usually continuing to grow and becoming many flowered and diffuse; peduncles and pedicels filiform with leaflike bracts and reduced bracteoles. Flowers pedicellate to sessile, bisexual, monomorphic. Calyx limb obsolete. Corolla salmon-orange to pale greenish, tubular to funnelliform, glabrous inside; lobes 4, valvate in bud. Stamens 4, inserted in upper part of corolla tube, included or partially exerted; filaments short; anthers dorsifixed, black. Ovary inferior, 2-celled, ovules 1 in each cell, basal; stigmas 2, globose, partially exerted. Fruit schizocarpous; mericarps obovoid, with 1 seed, indehiscent, upper part somewhat incurved, dry, with appressed short and curved hairs.

One species: from the SE Caucasus through Afghanistan and C Asia to NW China.

Ehrendorfer et al. (Fl. Iranica 176: 1–287. 2005) included the monotypic genus *Leptunis* in *Asperula* sect. *Trichodes* Boissier, based on the fol-

lowing arguments. Segregation of *Leptunis* as a monotypic genus from *Asperula* was based only on its ripe mericarps being rather obovoid and incurved than ellipsoid and straight. Furthermore, *Leptunis* appears closely linked to *Asperula* by *A. seticornis* Boissier. This local species from S Iran has long been recognized as having fruit that are intermediate in shape between *Leptunis* and “typical” *Asperula*. Nevertheless, considering the still incomplete DNA-analytical study of SW-Asiatic taxa of *Asperula* and the recent discovery of *Leptunis* in China (Abdusalih et al., Acta Bot. Boreal.-Occid. Sin. 23(4): 674. 2003), the genus is provisionally retained here. It is inserted in the key to Rubiaceae genera and species found in the present volume under *Galium*.

**1. *Leptunis trichodes*** (J. Gay ex Candolle) Schischkin, Fl. URSS 23: 285. 1958 [*“trichoides”*].

乐土草 le tu cao

*Asperula trichodes* J. Gay ex Candolle, Prodr. 4: 582. 1830; *Leptunis tenuis* Steven.

Herbs, annual, erect, 10–40 cm tall; stems and branches subterete, glabrous. Leaf blade drying stiffly papery, linear, 10–35 × 0.3–1 mm, glabrous to sparsely scaberulous, base acute, margins usually revolute, apex acute; 1 main vein as midrib, secondary veins not visible. Inflorescence 1–15 × 1–20 cm,

glabrous; bracts leaflike, 1–3.5 × 0.1–0.2 mm; pedicels lacking or up to 20 mm, thickened toward flowers. Corolla puberulent outside, 1.5–2 mm; lobes elliptic to ovate, 0.5–1 mm, obtuse. Ovary inferior, obovoid, ca. 1 × 1 mm. Mericarps 1–2 mm, with appressed short and curved hairs. Fl. Jun–Jul, fr. Jul–Aug.

Open ground and grasslands on mountains, riversides, sunny rocky slopes; 900–1500 m. Xinjiang (Ürümqi) [Afghanistan, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan; SW Asia (Azerbaijan, Iran)].

*Leptunis trichodes* was first documented from China by Abdusalih et al. (Acta Bot. Boreal.-Occid. Sin. 23(4): 674. 2003).

#### 47. **LERCHEA** Linnaeus, Mant. Pl. 2: 155, 256. 1771, nom. cons., not *Lerchia* Haller ex Zinn (1757).

多轮草属 duo lun cao shu

Chen Tao (陈涛); Charlotte M. Taylor

*Codaria* Linnaeus ex Kuntze.

Subshrubs or perennial herbs, unarmed, sometimes unbranched. Raphides present. Leaves opposite, often grouped at stem apices, perhaps without domatia; stipules caducous or persistent, interpetiolar, triangular or generally ligulate to obovate. Inflorescences terminal or pseudo-axillary, cymose, corymbiform, or racemiform with axes scorpioid, spiciform, or bearing small heads, several to many flowered, pedunculate, bracteate or bracts reduced. Flowers pedicellate to sessile, bisexual, distylous. Calyx limb shallowly to deeply 5-lobed, inside with well-developed colleters. Corolla white or yellowish green, tubular or funnelform, inside with pubescent ring in throat; lobes 5, often cucullate, valvate in bud. Stamens 5, inserted near or above middle of corolla tube, exerted or included; filaments developed; anthers dorsifixed, sometimes pubescent at one or both ends. Ovary 2-celled, ovules numerous in each locule on peltate axile placentas; stigma 2-lobed, stout, sometimes scabrous, exerted or included. Fruit baccate, fleshy except with bony endocarp, subglobose, with calyx limb persistent; seeds numerous, brown, small, angled.

About ten species: SE Asia; two species (one endemic) in China.

This genus was reviewed in detail in Sumatra and Java by Axelius (Blumea 32: 91–114. 1987). She noted among other observations that the plants are quite infrequently encountered in the field. The genus was apparently first reported from China by H. S. Lo (Bull. Bot. Res., Harbin 18: 275–283. 1998), who transferred one described species of *Ophiorrhiza* and *Xanthophytum* into *Lerchea*.

- 1a. Inflorescences with secondary axes mostly scorpioid; leaves with secondary veins 12–18 pairs; stipules caducous, not seen ..... 1. *L. micrantha*  
 1b. Inflorescences with secondary axes mostly dichasial; leaves with secondary veins 20–25 pairs; stipules persistent, 25–30 mm ..... 2. *L. sinica*

**1. *Lerchea micrantha*** (Drake) H. S. Lo, Bull. Bot. Res., Harbin 18: 275. 1998.

多轮草 duo lun cao

*Ophiorrhiza micrantha* Drake, J. Bot. (Morot) 9: 214. 1895; *Notodontia micrantha* (Drake) Pierre ex Pitard; *Spiradiclis micrantha* (Drake) H. S. Lo.

Herbs, rather fleshy; stems procumbent and rooting on nodes with apical parts ascending. Petiole densely pilosulous-hirtellous; leaf blade drying membranous, elliptic, ovate-elliptic, or lanceolate-oblong, 5–18 × 2.5–8 cm, base cuneate to rounded and often decurrent along petiole, apex acuminate or

obtuse; secondary veins 12–18 pairs; stipules caducous, not seen. Inflorescence terminal, ferruginous tomentose, 10–18 cm, many branched; secondary branches arcuate to recurved, mostly scorpioid, with flowers rather densely grouped; bracts reduced. Calyx with hypanthium portion weakly 5-ridged, 0.5–0.7 mm. Corolla white, shortly tubular; tube swollen in lower part; lobes obtuse. Berries subglobose, ca. 1.5 mm in diam.

Shady wet streamsides in forests. Yunnan (Hekou) [N Vietnam].

This species was incorrectly called *Polyura geminata* J. D. Hooker by Wu (Acta Phytotax. Sin. 6: 294. 1957) in its first report from China, but that was a misidentification. *Polyura* J. D. Hooker is an accepted genus of Rubiaceae but is not (yet) known from China.

**2. *Lerchea sinica*** (H. S. Lo) H. S. Lo, Bull. Bot. Res., Harbin 18: 275. 1998.

华多轮草 hua duo lun cao

*Xanthophytum sinicum* H. S. Lo, Guihaia 11: 97. 1991.

Suffrutescent herbs, rather fleshy, to 1 m tall; stems ascending, angled, densely villous. Petiole 3–6 cm, villous to hirsute; leaf blade drying papery, oblanceolate to elliptic, 18–27 × 7–10 cm, glabrous on both surfaces or pilose along midrib abaxially, base cuneate, apex acute or abruptly acute; secondary

veins 20–25 pairs; stipules persistent, obovate, 25–30 mm, parallel nerved, obtuse. Inflorescence terminal, paniculiform, lax, ca. 15 cm, multicellular villous; axes spreading to reflexed, mostly dichotomous with flowers rather closely grouped; bracts reduced; pedicels 0.5–1 mm. Calyx with hypanthium portion subturbinate to globose, ca. 2 mm, multicellular villous; lobes narrowly triangular, ca. 3.5 mm, glabrescent. Corolla yellowish green, tubular, glabrous outside; tube 3–3.5 mm; lobes triangular-ovate, ca. 1.5 mm. Fl. Aug.

• Dense forests. Yunnan (Hekou).

#### 48. *LUCULIA* Sweet, Brit. Fl. Gard. 2: t. 145. 1826.

滇丁香属 dian ding xiang shu

Chen Tao (陈涛); Charlotte M. Taylor

Shrubs or trees, unarmed. Raphides absent. Leaves opposite, sometimes with domatia; stipules caducous, interpetiolar, triangular, acute. Inflorescences terminal and sometimes in axils of uppermost leaves giving tripartite appearance, cymose and usually rounded-corymbiform, pedunculate, bracteate with bracts caducous. Flowers pedicellate, bisexual, distylous, generally showy. Calyx limb deeply 5-lobed, lobes well developed to subleaflike, usually deciduous shortly after anthesis and often before corolla. Corolla red to pink or white, salverform; tube prolonged and in long-styled form expanded in throat to enclose anthers, with upper part of throat spreading with lobes at anthesis, glabrous inside; lobes 5, imbricate (and apparently quincuncial) in bud, rounded, margins usually crisped and slightly irregular, sometimes with a lamellate basal appendage on each side. Stamens 5, inserted in upper part of corolla tube, included in long-styled form or partially to completely exerted in short-styled form; filaments short; anthers dorsifixed. Ovary 2-celled, ovules numerous in each cell on axile placentas; stigmas 2, linear, included in short-styled form or exerted in long-styled form. Fruit capsular, obovoid to ellipsoid, smooth, septicidally dehiscent from apex for half or completely, woody, becoming deflexed, with calyx limb caducous; seeds numerous, small, fusiform, flattened, prolonged into narrow wings at each end; endosperm fleshy; embryo minute, slightly clavate; cotyledons obtuse.

About five species: Bhutan, China, India, Myanmar, Nepal, Thailand, Vietnam; three species (one endemic) in China.

The relationships of *Luculia* have not been clear until recently, when molecular studies (e.g., Bremer et al., Syst. Biol. 48: 413–435. 1999) found it to be basal in the Rubiaceae. Additional references regarding *Luculia*'s biology and classification, not listed here, were cited by Rydin et al. (Pl. Syst. Evol. 278: 101–120. 2009).

The treatment here summarizes the existing taxonomy, as a basis for future work; it seems possible that there are only two species in China, but evaluation of this is beyond the scope of this study and the available specimens. Hutchinson (in Sargent, Pl. Wilson. 3: 408. 1916) gave taxonomic significance at the species level to the presence vs. absence of "striking flap-like processes upon and continuous between the lobes of the corolla" for separating species of *Luculia*; these structures have not been much studied or detailed by other authors.

- 1a. Corolla tube 30–50 mm; corolla lobes 12–15 mm wide, suborbicular to broadly elliptic, without lamellate appendages at their bases ..... 1. *L. gratissima*  
 1b. Corolla tube 25–32 mm; corolla lobes 9–15 mm wide, obovate to suborbicular, usually with a lamellate appendage at each side of base inside.  
 2a. Inflorescence axes, hypanthium portion of calyx, and fruit glabrous or sparsely hirtellous or pilosulous, surfaces of structures easily visible between trichomes ..... 2. *L. pinceana*  
 2b. Inflorescence axes, hypanthium portion of calyx, and fruit densely tomentose, surfaces of structures completely covered by pubescence ..... 3. *L. yunnanensis*

**1. *Luculia gratissima*** (Wallich) Sweet, Brit. Fl. Gard. 2: t. 145. 1826.

馥郁滇丁香 fu yu dian ding xiang

*Cinchona gratissima* Wallich in Roxburgh, Fl. Ind. 2: 154. 1824; *Mussaenda luculia* Buchanan-Hamilton ex D. Don, nom. illeg. superfl.

Shrubs or small trees, to 5 m tall, with thin pale brown bark; branches somewhat flattened to subterete, pilosulous [to glabrous], sometimes with sparse elliptic lenticels. Petiole 0.8–2 cm, pilosulous to glabrous; leaf blade drying papery or thinly

leathery, elliptic, lanceolate-elliptic, lanceolate, or elliptic-oblong, 5–15 × 2–6 cm, adaxially glabrous, abaxially pilosulous at least along principal veins, base cuneate or acute, apex acute to acuminate; secondary veins 8–12 pairs, sometimes with pilosulous domatia; stipules lanceolate to narrowly lanceolate, 6–8 mm, glabrous to strigillose, acute to acuminate. Inflorescence corymbiform, many flowered, villosulous to pilosulous; peduncle 2–3 cm; branched portion 3–5 × 6–8 cm (not including corollas); bracts linear to narrowly ligulate, 4–7 mm, acute; pedicels 4–5 mm. Calyx glabrous to densely hirtellous; ovary portion obovoid, 3–4 mm; lobes lanceolate, oblanceolate, or narrowly ligulate, 10–16 mm, acute. Corolla red, outside glabrous;

tube 30–50 mm, slenderly cylindrical; lobes suborbicular to broadly elliptic, 11–12 × 12–15 mm, rounded. Capsule 1–2 × 1–1.5 cm, pilosulous to glabrous; seeds 2–3 mm, spongy-reticulate. Fl. and fr. Apr–Nov.

Forests or thickets on mountains; 800–2400 m. Xizang (Médog), Yunnan [Bhutan, NE India, Myanmar, Nepal, Thailand, Vietnam].

W. C. Chen (in FRPS 71(1): 239. 1999) distinguished this from other species of *Luculia* in part by its villous pubescence on the calyx and hypanthium, but some individual specimens seen vary from densely pubescent to glabrous. The pollination biology of this species was studied by Murray (Ann. Bot. 65: 691–698. 1990).

**2. *Luculia pinceana*** Hooker in Curtis, Bot. Mag. 71: t. 4132. 1845.

滇丁香 dian ding xiang

Shrubs or trees, 2–10 m tall; branches flattened to subterete, with usually rather dense elliptic lenticels, hirtellous to glabrous. Petiole 1–3.5 cm, glabrous or hirtellous; leaf blade drying stiffly papery to thinly leathery and paler below, elliptic, elliptic-oblong, or oblanceolate, 5–22 × 2–8 cm, adaxially glabrous, abaxially glabrous or hirtellous to strigillose on principal veins to throughout, base cuneate, acuminate, or obtuse, apex acuminate; secondary veins 9–14 pairs, often with pilosulous domatia; stipules triangular to narrowly triangular, 5–19 mm, glabrous, long acuminate. Inflorescence corymbiform, many flowered, glabrous; peduncle 2–8 cm; branched portion 2–6 × 3–8 cm (not including corollas); bracts stipuliform, linear-lanceolate, 12–15 mm, glabrous, acute; pedicels 2–6 mm. Calyx glabrous or sparsely hirtellous; ovary portion cylindrical-obovoid, 4–5 mm; lobes lanceolate to narrowly oblanceolate, 8–18 × 2–6 mm, often ciliate, acute. Corolla red or rarely white, glabrous; tube slenderly cylindrical, 30–32 mm; lobes suborbicular, 15–22 × 11–15 mm, at base with a lamellate appendage on each side inside, apex rounded. Capsules obovoid to ellipsoid-obovate, 15–25 × 5–10 mm, weakly longitudinally ridged, glabrous or sparsely hirtellous; seeds ca. 4 mm. Fl. and fr. Mar–Dec.

Forests or thickets on mountain slopes, streamsides in valleys; 600–3000 m. Guangxi, Guizhou, Xizang, Yunnan [India, Myanmar, Nepal, Vietnam].

The varieties below were recognized by W. C. Chen in FRPS (71(1): 239–241. 1999) and are included here for reference.

- 1a. Branchlets and peduncles glabrous ..... 2a. var. *pinceana*  
1b. Branchlets and peduncles pubescent .... 2b. var. *pubescens*

**2a. *Luculia pinceana* var. *pinceana***

滇丁香(原变种) dian ding xiang (yuan bian zhong)

*Luculia intermedia* Hutchinson.

Branchlets and peduncles glabrous. Fl. and fr. Mar–Nov.

Forests or thickets on mountain slopes, streamsides in valleys; 600–3000 m. Guangxi, Guizhou, Xizang, Yunnan [India, Myanmar, Nepal, Vietnam].

**2b. *Luculia pinceana* var. *pubescens*** (W. C. Chen) W. C. Chen, Fl. Reipubl. Popularis Sin. 71(1): 241. 1999.

毛滇丁香 mao dian ding xiang

*Luculia intermedia* var. *pubescens* W. C. Chen, Acta Phytotax. Sin. 22: 139. 1984.

Branchlets and peduncles pubescent. Fl. and fr. Apr–Dec.

• Forests or thickets on mountain slopes or at streamsides; 600–1800 m. Guangxi (Napo), Xizang (Médog), Yunnan.

**3. *Luculia yunnanensis*** S. Y. Hu, J. Arnold Arbor. 32: 398. 1951.

鸡冠滇丁香 ji guan dian ding xiang

Shrubs and trees, 3.5(–10) m tall; branches weakly flattened to terete, densely tomentose to hirtellous, with dense elliptic lenticels. Petiole 0.8–2 cm, sparsely pilosulous to glabrous; leaf blade drying leathery or stiffly papery, oblanceolate, oblanceolate-oblong, or elliptic-oblong, 5.5–18 × 2–5.5 cm, adaxially glabrous, abaxially glabrous except strigose to pilose along principal veins, base cuneate or acute, apex acute to acuminate; secondary vein 9–14 pairs, usually with pilosulous domatia; stipules lanceolate to narrowly triangular, 4–14 mm, glabrous, acute to acuminate. Inflorescence corymbiform, many flowered, densely tomentose; peduncle 1.5–3.5 cm; branched portion 5–10 × 6–15 cm (not including corollas); bracts linear to narrowly spatulate, 5–15 mm; pedicels 3–10 mm. Calyx with ovary portion obconic, 5–6 mm, densely tomentose; lobes lanceolate to narrowly ligulate or narrowly oblanceolate, 12–20 × 3–3.5 mm, glabrous except strigose along veins and margins, apex acute to shortly acuminate. Corolla red, outside glabrous; tube 25–32 mm, cylindrical to slightly funnelform; lobes suborbicular to obovate, 13–18 × 9–12 mm, with 2 lamellate appendages or crests at each side of base inside, apex rounded. Capsules obovoid, 1.5–2.5 × 0.5–0.8 mm, smooth to weakly ridged, densely tomentose; seeds 2–4 mm. Fl. and fr. Mar–Nov.

• Forests or thickets on mountains; 1200–3200 m. Yunnan.

**49. METADINA** Bakhuizen f., Taxon 19: 472. 1970.

黄棉木属 huang mian mu shu

Chen Tao (陈涛); Charlotte M. Taylor

Trees, unarmed; buds pyramidal to conical with stipules obvolvate. Raphides absent. Leaves opposite, sometimes with domatia; stipules caducous, interpetiolar, generally triangular. Inflorescences terminal and in axils of uppermost leaves, capitate with several globose heads in fascicles or cymes, many flowered, pedunculata, bracteate; peduncles articulate; bracts often subtending heads; bracteoles filiform to filiform-clavate. Flowers sessile, bisexual, monomorphic. Calyx limb 5-lobed. Corolla color not noted, salverform to narrowly funnelform, inside glabrous; lobes 5, in bud valvate except apices subimbricate. Stamens 5, inserted in upper part of corolla tube, partially exserted; filaments short; anthers basifixed. Ovary 2-celled, ovules 4–12 in each cell, pendulous on axile pla-

centas attached in upper third of septum; stigma globose to clavate, smooth, exerted. Fruit capsular, obconic, septicidally then sometimes loculicidally dehiscent into 2 or 4 valves from base to apex, woody to stiffly papery, with calyx limb persistent on persistent septum; seeds several, small, subglobose to trigonous or ellipsoid, unwinged.

One species: Cambodia, China, India, Indonesia, Laos, Malaysia, Myanmar, Philippines, Thailand, Vietnam.

The taxonomy of this genus here follows Ridsdale (Blumea 24: 350–351. 1979), with a broader morphological variation as found in more recently collected specimens, in particular in inflorescence morphology. This taxonomy is complicated by varied application of the name *Adina polycephala*: Ridsdale treated this as a synonym of *Metadina trichotoma*, but older Chinese authors (in herb.) have long applied it to the plants treated here as *A. pubicostata*.

**1. *Metadina trichotoma*** (Zollinger & Moritzi) Bakhuizen f., Taxon 19: 472. 1970.

黄棉木 huang mian mu

*Nauclea trichotoma* Zollinger & Moritzi, Syst. Verz. 61. 1846; *Adina polycephala* Benthams; *A. trichotoma* (Zollinger & Moritzi) Benthams & J. D. Hooker ex B. D. Jackson; *A. zschokkei* Elmer; *N. polycephala* Wallich ex G. Don (1834), not A. Richard ex Candolle (1830).

Trees, apparently evergreen, flowering at 5–10 m tall; branches compressed becoming terete, brown to gray, puberulent to glabrous, usually densely lenticellate with elliptic white raised lenticels. Petiole 3–10 mm, glabrous; leaf blade drying stiffly papery to subleathery, lanceolate, elliptic-lanceolate, or ovate-oblong, 6–20 × 2–7 cm, adaxially glabrous and rather shiny, abaxially glabrous to puberulent or tomentulose at least along veins, base acute to obtuse, apex acute to caudate-acumi-

nate; secondary veins 8–12 pairs, sometimes with small pilosulous domatia in axils; stipules deltoid to narrowly triangular, 5–8 mm, acute to perhaps obtuse. Inflorescence glabrous to densely puberulent or tomentulose; peduncles 1.5–3 cm, usually articulate and with 4 caducous bracts 1–3 mm near middle; flowering heads 6–7 mm in diam. across calyces, ca. 12 mm in diam. across corollas; bracteoles ca. 2 mm. Calyx with ovary portion obconic, 0.5–1 mm, pilosulous to glabrescent, surrounded at base by a ring of pilose trichomes ca. 0.5 mm; limb lobed essentially to base; lobes 1–2 mm, narrowly elliptic-oblong, obtuse. Corolla outside glabrous; tube 3–3.5 mm; lobes triangular-spatulate, ca. 1 mm. Stigmas obconic, ca. 1 mm, exerted for ca. 5 mm. Fruiting head 8–10 mm in diam. Capsules obovoid to obconic, ca. 1.5 mm, pilosulous at least on apical portion. Fl. and fr. Apr–Dec.

Forests at streamsides in valleys; 300–1400 m. Guangdong, Guangxi, Hunan, Yunnan [Cambodia, India, Indonesia, Laos, Malaysia, Myanmar, Philippines, Thailand, Vietnam].

## 50. *MICROPHYSA* Schrenk, Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Petersbourg 2: 115. 1844.

泡果茜草属 pao guo qian cao shu

Chen Tao (陈涛); Friedrich Ehrendorfer

Herbs, perennial, rhizomatous. Raphides present. Stems rough. Leaves and leaflike stipules of middle stem region in whorls of 4, without domatia, sessile or subsessile. Inflorescences terminal, thyrsoid, corymbose, cymes pedunculate, several to many flowered, bracteate but bracteoles strongly reduced. Flowers sessile to pedicellate, remarkably small, bisexual, monomorphic. Calyx limb obsolete. Corolla white, funnel-shaped, glabrous; lobes 4, valvate in bud. Stamens 4, inserted on upper part of corolla tube, exerted; filaments short; anthers dorsifixed. Ovary (hypanthium) with 2 cells, each with 1 erect ovule inserted at base of placenta; stigma 2-lobed, exerted. Fruit indehiscent or tardily schizocarpous, dry, with pericarp leathery and inflated (i.e., bladderlike) and usually including both seeds at dispersal; seeds small, ellipsoid-oblong or plano-convex, grooved on ventral (i.e., adaxial) side; testa membranous; endosperm corneous; embryo curved; cotyledons leaflike; radicle terete, hypogynous.

One species: NW China, Kazakhstan, Uzbekistan.

*Microphysa* was originally described as *Asperula elongata*. Its subsequent generic separation by Schrenk (Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Petersbourg 2: 116. 1844) was justified by its peculiar fruit structure. Only much later, Ehrendorfer et al. (Fl. Iranica 176: 161–258. 2005) postulated that *Microphysa* (as well as *A. platygalium* and *A. maximoviczii*: see under *Galium*), in spite of their funnel-shaped corollas, phylogenetically belong to *G. sect. Platygalium* (usually with rotate corollas), a section to which they correspond in all remaining essential characters. In the aberrant fruit of *Microphysa* the two parts of the inferior ovary do not develop into separate mericarps, each with its own pericarp, but remain united within a ± inflated leathery and common pericarp. Nevertheless, this peculiar development is not limited to *Microphysa* but, according to personal observations (F. Ehrendorfer), also occurs sporadically within populations of the *G. boreale-G. rubioides* group (corresponding to the series *G. ser. Rubioidea* Pobedimova and *G. ser. Borealia* Pobedimova within *G. sect. Platygalium*; cf. Pobedimova et al., Fl. URSS 23: 345–354. 1958). Thus, on the basis of available evidence, the single species of *Microphysa* should be placed into *G. sect. Platygalium*.

Considering that *Microphysa* was separated as a monotypic genus by Pobedimova (loc. cit.) and by H. S. Lo (in FRPS 71(2): 318. 1999), and that DNA-analytical proof for its transfer to *Galium* sect. *Platygalium* is still lacking, the genus is maintained here provisionally. Furthermore, its possible future transfer will make a new species name necessary, because “*elongata*” has been used already for another taxon within *Galium*.

**1. *Microphysa elongata*** (Schrenk) Pobedimova in Schischkin, Fl. URSS 23: 286. 1958.

泡果茜草 pao guo qian cao

*Asperula elongata* Schrenk in Fischer & C. A. Meyer, Enum. Pl. Nov. 1: 58. 1841; *Microphysa galioides* Schrenk.

Herbs, perennial, erect, rhizomatous. Stems 30–50(–70)

cm tall, with 4 scabrous angles. Leaf blade drying subleathery, linear-lanceolate, lanceolate, or narrowly oblong, 30–60 × 3–5(–12) mm, glabrous except antrorsely aculeolate along margins and veins abaxially, base acute, margins thinly revolute, apex acute or obtuse; vein 1, distinct, secondary veins not visible. Inflorescence corymbose, with scabrous axes, inconspicuously bracteate. Ovary ellipsoid, 1.5–2 mm, glabrous. Co-

rolla funnel-shaped, 2.5–3 × 3.5–4 mm, lobed to ca. 1/2 length or slightly more; tube 1.2–1.5 mm; lobes elliptic-oblong, shortly acuminate. Fruit 3–4 mm in diam., vesicular, smooth to granulate; seeds ca. 1 × 1 mm. Fl. and fr. May–Jul.

Meadows, banks of rivers and lakes, foothills and lower mountains. Xinjiang (Chabuchaer) [Kazakhstan, Uzbekistan].

## 51. MITCHELLA Linnaeus, Sp. Pl. 1: 111. 1753.

蔓虎刺属 man hu ci shu

Chen Tao (陈涛); Charlotte M. Taylor

*Chamaedaphne* Mitchell; *Perdicesca* Provancher.

Herbs, perennial, unarmed, creeping, rooting at nodes. Raphides present. Leaves opposite, without domatia; stipules generally persistent, interpetiolar, triangular, entire to deeply 3(–5)-lobed, often glandular at apex. Inflorescences terminal or pseudoaxillary near stem apices, 2-flowered, pedunculate, ebracteate. Flowers sessile, bisexual, distylous, fused in pairs by their ovaries. Calyx with ovary portion of individual flowers subglobose, with structure formed by fused ovaries oblate to dicoccos, with limb of individual flowers (3 or)4-lobed. Corolla white, funnellform, pilose in throat and onto lobes; lobes (3 or)4, valvate in bud. Stamens (3 or)4, inserted in corolla throat, exerted in short-styled flowers, included in long-styled flowers; filaments stout; anthers basifixed. Ovary of individual flowers 4-celled, ovules 1 in each cell, axile; stigmas 4, linear, exerted in long-styled flowers, included in short-styled flowers. Fruit multiple, orange to red, drupaceous, subglobose to oblate, fleshy, with calyx limbs 2, persistent; pyrenes 8, 1-celled, each with 1 seed, angled, 3-ridged; seeds medium-sized, ellipsoid; endosperm corneous; embryo small; radicle hypogynous.

Two species: one in E Asia (China, Japan, Korea), the other in Central America (Guatemala) and E North America (Canada, Mexico, United States); one species in China.

Y. Z. Ruan (in FRPS 71(2): 159. 1999) gave the number of calyx lobes, corolla lobes, and stamens as 3 or 4; in general, the flowers of *Mitchella* are considered 4-merous, although throughout Rubiaceae occasional individual flowers vary from the “characteristic” in having fewer or more calyx lobes, corolla lobes, and infrequently also stamens.

**1. *Mitchella undulata*** Siebold & Zuccarini, Abh. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. 4(3): 175. 1846.

蔓虎刺 man hu ci

*Mitchella repens* Linnaeus var. *undulata* (Siebold & Zuccarini) Makino.

Plants with stems quadrate, to 30 cm, glabrous or subglabrous. Petiole 0.3–1.1 cm, glabrous or subglabrous; leaf blade drying papery, triangular-ovate or ovate, 0.2–2.1 × 0.2–1.5 cm, both surfaces glabrous, base truncate or cordulate to rounded, margins sometimes undulate, apex acute to rounded; secondary veins 2 or 3 pairs; stipules 1–1.5 mm. Flowers with peduncles 1–12 mm, glabrous. Calyx glabrous; ovary portion

subglobose to turbinate, ca. 2 mm; limb deeply lobed; lobes narrowly to broadly triangular, 0.5–1 mm. Corolla glabrous outside; tube 9–10 mm; lobes lanceolate to triangular, 4–5 mm, acute. Multiple fruit subglobose, 6–8 mm in diam., glabrous; pyrenes ca. 2.5 mm. Fl. autumn, fr. winter.

Understories of wet forests. Taiwan, Zhejiang [Japan, Korea].

In Fl. Taiwan (ed. 2, 4: 297. 1998) Liu and Yang reported the plants there are evergreen. Y. Z. Ruan (in FRPS 71(2): 159. 1999) described the leaf blades as unequal and gave measurements for large ones and small ones without further explanation. All other authors reported this species to be generally isophyllous, which corresponds to specimens seen. The leaf description by Ruan may apply to the variable leaf sizes along the stems of some plants, rather than consistent size differences between the two leaves at a single stem node.

## 52. MITRACARPUS Zuccarini in Schultes & J. H. Schultes, Mant. 3: 210 [“*Mitracarpum*”], 399. 1827.

盖裂果属 gai lie guo shu

Chen Tao (陈涛); Charlotte M. Taylor

Herbs [to small shrubs], annual or perennial, unarmed. Raphides present. Leaves opposite, subsessile or sessile, without domatia; stipules persistent, interpetiolar and fused to leaf bases or petioles, truncate to rounded, setose. Inflorescences terminal and/or axillary, glomerulate or capitate, several to many flowered, sessile, sometimes immediately subtended by 1 or 2 pairs of leaves, bracteate. Flowers sessile, bisexual, monomorphic. Calyx limb deeply 4(or 5)-lobed; lobes usually unequal in pairs, usually with hyaline margins. Corolla white, salverform or funnellform, inside glabrous or pubescent in throat; lobes 4, valvate in bud. Stamens 4, inserted in corolla throat, included or exerted; filaments developed; anthers dorsifixed. Ovary 2-celled, ovules 1 in each cell on peltate axile placentas attached at middle of septum; stigmas 2, linear, usually exerted. Fruit capsular, subglobose to somewhat dicoccos, with dehiscence circumscissile around equator, with apical valve or “lid” deciduous and basal portion persistent, papery to

cartilaginous, with calyx limb persistent or deciduous on lid; seeds 2, medium-sized, oblate to rounded, on ventral (i.e., adaxial) face with cruciform (i.e., X-shaped) scar; endosperm fleshy; cotyledon leaflike; radicle hypogeous.

About 30 species: widespread in tropical and subtropical Central, North, and South America and the Antilles, with one species widely naturalized in tropical Africa, Asia, Australia, and Pacific islands; one species (introduced) in China.

This genus is frequently overlooked even in its native range, but the circumscissile capsules, seeds with a distinctive cruciform scar, leaves scabrous to the touch on the upper surface, and well-developed calyx lobes with hyaline erose margins are distinctive. W. C. Ko (in FRPS 71(2): 210. 1999) described the ovary as sometimes 3-celled; this condition is not otherwise known in *Mitracarpus* and has not been reconfirmed, although it does characterize the very similar, likewise adventive genus *Richardia*.

**1. *Mitracarpus hirtus*** (Linnaeus) Candolle, Prodr. 4: 572. 1830.

盖裂果 gai lie guo

*Spermacoce hirta* Linnaeus, Sp. Pl., ed. 2, 1: 148. 1762; *Mitracarpus scaber* Zuccarini; *M. senegalensis* Candolle; *M. verticillatus* (Schumacher & Thonning) Vatke; *M. villosus* (Swartz) Candolle; *S. villosa* Swartz; *Staurospermum verticillatum* Schumacher & Thonning.

Herbs, annual, branched, 40–80 cm tall; branches flattened to subterete or 4-angled, sometimes becoming woody in lower part, sparsely hirsute to villous. Leaves sessile; blade drying thinly papery, elliptic-oblong or lanceolate, 3–4.5 × 0.7–1.5 cm, adaxially scaberulous and usually also sparsely villosulous or pilosulous, abaxially moderately to densely villous or pilose, base acute to obtuse or rounded, apex acute; secondary veins 3–6 pairs; stipule sheaths 1–4 mm, villosulous or pilosulous to glabrescent, with 1–9 setae 1–5 mm. Inflorescences 5–20 mm in diam. (not including subtending leaves), villosulous or pilosulous; bracts linear, 1–2 mm. Calyx sparsely to densely puberulent or strigillose; ovary portion subglobose to ellipsoid, ca.

0.5 mm; limb deeply lobed; lobes unequal, triangular to lanceolate, 2 larger 1.8–2 mm, 2 smaller 0.8–1.2 mm, ciliate. Corolla funnelform, outside puberulent to glabrous; tube 1–1.5 mm, glabrous inside; lobes triangular to ovate, 0.5–1 mm, obtuse to acute. Capsules subglobose, ca. 1 mm in diam., scaberulous or sparsely puberulent; seeds dark brown, oblate-suboblong, ca. 0.8 mm. Fl. and fr. Apr–Nov.

Wastelands at highway sides; near sea level to 800 m. Hainan (Wanning), Hong Kong, Yunnan [native to the Antilles and Central, North, and South America; naturalized in tropical Africa, Asia, Australia, and Pacific islands].

The correct name for this species, whether *Mitracarpus hirtus* or *M. villosus*, has been controversial (for additional comments, see Taylor et al., Fl. Venez. Guayana 8: 497–847. 2004); most authors working with neotropical Rubiaceae today use the name *M. hirtus*. The capsules of all the Chinese specimens studied are smaller than those of neotropical plants. Fruit of similar size are found in plants of India (Sebastine & Ramamurthy, Bull. Bot. Surv. India 9: 291–292. 1967, see in particular f. 1–7) and may characterize several adventive populations. W. C. Ko (in FRPS 71(2): 212. 1999, as *M. villosus*) suggested that this species might be distylous, but *Mitracarpus* is monomorphic so far as known.

**53. MITRAGYNA** Korthals, Observ. Naucl. Indic. 19. 1839, nom. cons., not *Mitragyne* R. Brown (1810).

帽蕊木属 mao rui mu shu

Chen Tao (陈涛); Charlotte M. Taylor

*Paradina* Pierre ex Pitard; *Stephegyne* Korthals.

Trees, unarmed; buds flattened, with stipules erect and pressed together. Raphides absent. Leaves opposite, sometimes with domatia; stipules caducous, interpetiolar, generally ovate to obovate, sometimes keeled, entire, often well developed. Inflorescences terminal on main stems and axillary branches and often accompanied by reduced, petaloid, and/or bracteate leaves, capitata with globose heads in fascicles, cymes, umbels, or thyrses, sessile to shortly pedunculate, bracteate; bracteoles spatulate to obpyramidal. Flowers sessile, bisexual, monomorphic. Calyx limb truncate to 5-lobed. Corolla cream to yellow-green, funnelform or narrowly salverform, inside glabrous to variously pubescent; lobes 5, valvate in bud. Stamens 5, inserted near corolla throat, exerted or included; filaments short; anthers basifixed, partially to fully exerted. Ovary 2-celled, ovules numerous in each cell on fleshy, pendulous, axile placentas attached in upper third of septum; stigma clavate to mitriform (i.e., upside-down cupular), exerted. Fruit capsular, obovoid to ellipsoid, septicidally then loculicidally dehiscent, cartilaginous to woody, with calyx limb persistent or deciduous; seeds numerous, small, somewhat flattened, fusiform to lanceolate, shortly winged at both ends with basal wing sometimes bifid or notched.

About seven species: one species in Africa, six species in Asia and Malesia; three species in China.

Ridsdale reviewed this genus in detail (Blumea 24: 46–68. 1978) and excluded the African species. H. H. Hsue and H. Wu (in FRPS 71(1): 245. 1999) reported only *Mitragyna rotundifolia* from China; Ridsdale (loc. cit.: 65) reported only *M. diversifolia* from China; and Wu (Acta Phytotax. Sin. 6: 293. 1957) reported a third species, *M. hirsuta*, in a report that has been overlooked. Several other species of *Mitragyna* are found widely in Thailand and Myanmar, as well as cultivated for lumber, and should be expected in China (in particular, see comments under *M. diversifolia*). The leaves of *M. speciosa* (Korthals) Haviland are the source of kratom and used for tea, chewing, smoking, and as medicine in Thailand and Malaysia; the main active ingredient here is the alkaloid mitragynine, known only from this species and said to be stimulating at low doses but narcotic at high doses.

- 1a. Calyx limb deeply lobed, with lobes 1.5–2.5 mm, spatulate to oblanceolate, usually quite evident on fruit ..... 2. *M. hirsuta*  
 1b. Calyx limb subtruncate or lobed for up to 1/2, with lobes up to 1 mm, triangular, deciduous or at least hardly evident on fruit.  
 2a. Branch leaves 6–14 × 3–9 cm, with secondary veins strongly ascending (i.e., departing midrib at 55°–75°); corolla tube ca. 3 mm, lobes ca. 2.5 mm ..... 1. *M. diversifolia*  
 2b. Branch leaves 9–25 × 6–20 cm, with secondary veins spreading (i.e., departing midrib at 35°–60°); corolla tube 2–3 mm, lobes 4–5 mm ..... 3. *M. rotundifolia*

**1. *Mitragyna diversifolia*** (Wallich ex G. Don) Haviland, J. Linn. Soc., Bot. 33: 71. 1897.

异叶帽蕊木 yi ye mao rui mu

*Nauclea diversifolia* Wallich ex G. Don, Gen. Hist. 3: 467. 1834; *Stephegyne diversifolia* (Wallich ex G. Don) J. D. Hooker.

Trees, perhaps deciduous, to 15 m tall; branches angled becoming terete, pilosulous to glabrescent. Petiole 5–15 mm, glabrous, puberulent, or pilosulous; leaf blade drying papery, ovate-oblong to elliptic-ovate, 6–14 × 3–9 cm, adaxially glabrous, abaxially sparsely to densely pilosulous or tomentulose, base rounded to cordulate, apex obtuse to shortly acuminate; secondary veins 8 or 9 pairs, strongly ascending, sometimes with pilosulous domatia in abaxial axils; stipules elliptic-oblong to ovate, ca. 2.5 cm, strigillose to glabrous, abaxially weakly to strongly keeled and pilosulous, apex obtuse to rounded. Inflorescence densely pilosulous or strigillose to glabrescent; peduncles 1–3 mm (i.e., portion above articulation of subtending leaves but not including entire growth of branch); flowering heads 3 to numerous, 8–10 mm in diam. across calyces, 13–20 mm in diam. across corollas; bracteoles linear-spatulate, ca. 3 mm, glabrous to sparsely ciliolate. Calyx glabrous; ovary portion obconic, ca. 1.5 mm; limb ca. 1.5 mm, subtruncate to lobed for up to ca. 1/2; lobes triangular, obtuse. Corolla yellowish white, outside glabrous, inside densely pilosulous in throat and on lobes; tube ca. 3 mm; lobes triangular, ca. 2.5 mm, acute. Fruiting heads 8–10 mm in diam. Capsules 3–4 mm, with persistent calyx limb markedly thickened; seeds 1–2 mm. Fl. [Feb, Jul, Aug], fr. [Jan, Mar, Dec].

Forests; [300–400 m]. Yunnan [Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Thailand, Vietnam].

This species seems to be similar to and at least sometimes confused with the commonly collected *Mitragyna parvifolia* (Roxburgh) Korthals; these species differ at least in their corollas, with the tube 5–6 mm and substantially longer than the lobes ca. 2 mm in *M. parvifolia*, vs. the tube ca. 3 mm and less than twice as long as the lobes ca. 2.5 mm in *M. diversifolia*. Ridsdale (Blumea 24: 63–65. 1978) reported a difference in the distribution of these, with *M. parvifolia* primarily found in India and Sri Lanka and *M. diversifolia* to the north and east of this, including China. Puff et al. (Rubiaceae of Thailand, 46. 2005) noted that in Thailand *M. diversifolia* is most often found in deciduous vegetation and is common in secondary vegetation, in particular in edges along fields.

**2. *Mitragyna hirsuta*** Haviland, J. Linn. Soc., Bot. 33: 72. 1897.

毛帽蕊木 mao mao rui mu

*Paradina hirsuta* (Haviland) Pitard.

Trees, deciduous, to 20 m tall; branches angled to terete,

densely pilosulous to glabrescent. Petiole 5–30 mm, glabrous to densely pilosulous; leaf blade drying stiffly papery, suborbicular to broadly elliptic or ovate, 8–18(–30) × 2–12(–20) cm, adaxially glabrous, abaxially sparsely to densely pilosulous or rarely glabrescent, base broadly obtuse to cordulate, apex rounded to acute; secondary veins 6–12 pairs, spreading, sometimes with pilosulous domatia in abaxial axils; stipules elliptic-oblong to ovate, 10–20 × 8–15 mm, pilosulous and weakly keeled, apex obtuse to rounded. Inflorescences densely puberulent to pilosulous; flowering heads sessile, 7 to numerous, 10–12 mm in diam. across calyces, 20–25 mm in diam. across corollas; bracteoles linear-spatulate, 2.5–3.5 mm, glabrous to sparsely pubescent and/or ciliolate. Calyx glabrous; ovary portion obconic, 1.2–2 mm; limb deeply lobed; lobes oblanceolate to spatulate, 1.5–2.5 mm, entire to ciliolate. Corolla yellow, outside glabrous, inside densely hairy; tube 5–6 mm; lobes narrowly elliptic, 2–2.5 mm, acute. Fruiting heads 15–20 mm in diam. Capsules 5–8 mm, weakly ridged; seeds ca. 1 mm. Fl. [Jun–Jul, Dec], fr. [Apr, Dec].

Forests; [100–1500 m]. Yunnan [Cambodia, Laos, Myanmar, Thailand, Vietnam].

This species was illustrated by Ridsdale (Blumea 24: 60, f. 6. 1978).

**3. *Mitragyna rotundifolia*** (Roxburgh) Kuntze, Revis. Gen. Pl. 1: 289. 1891.

帽蕊木 mao rui mu

*Nauclea rotundifolia* Roxburgh, Fl. Ind. 2: 124. 1824; *Mitragyna brunonis* (Wallich ex G. Don) Craib; *N. brunonis* Wallich ex G. Don.

Trees, perhaps deciduous, to 30 m tall; branches angled to subterete, glabrous to glabrescent. Petiole 15–60 mm, glabrous to densely pilosulous; leaf blade drying papery, suborbicular to broadly elliptic or ovate, 9–25 × 6–20 cm (to 75 cm on seedlings and sprouts), adaxially glabrous to puberulent, abaxially sparsely to densely pilosulous or tomentulose, base rounded to cordate, apex obtuse; secondary veins 5–7 pairs, spreading, sometimes with pilosulous domatia in abaxial axils; stipules elliptic-oblong to ovate, 13–50 × 5–30 mm, pilosulous, keeled, apex obtuse to rounded. Inflorescences densely puberulent to pilosulous; peduncles 1–3 mm (i.e., portion above articulation of subtending leaves but not including internode below node bearing inflorescence); flowering heads 1–5, 7–10 mm in diam. across calyces, 15–20 mm in diam. across corollas; bracteoles linear-spatulate, 1–1.5 mm, glabrous or sparsely pubescent. Calyx glabrous; ovary portion 1.5–3 mm; limb ca. 0.5 mm, subtruncate to lobed for ca. 1/2; lobes triangular, obtuse. Corolla yellowish white, outside glabrous, densely hairy inside; tube 2–3 mm; lobes narrowly oblanceolate, 4–5 mm, acute. Fruiting heads 10–16 mm in diam. Capsules 3–5 mm, weakly

ridged, with persistent calyx thickened; seeds ca. 1 mm. Fl. [Aug–Nov], fr. Sep, Dec.

Dense forests; ca. 1000 m. S Yunnan [Bangladesh, India, Laos, Myanmar, Thailand].

This species was illustrated by Ridsdale (Blumea 24: 66, f. 8. 1978). Puff et al. (Rubiaceae of Thailand, 46. 2005) noted that in Thailand this species is most often found in deciduous vegetation and is common in secondary vegetation.

#### 54. MORINDA Linnaeus, Sp. Pl. 1: 176. 1753.

巴戟天属 *ba ji tian shu*

Chen Tao (陈涛); Charlotte M. Taylor

*Rojoc* Adanson.

Lianas, climbing shrubs, erect shrubs, or small trees, rarely dioecious, sometimes with spines; branching sometimes sylleptic with growth continued from an axillary or subapical node, with lateral branches sometimes surrounded at base by persistent leafless stipules. Raphides present. Leaves opposite, rarely ternate, or sometimes anisophyllous and apparently 1 at flowering nodes, sometimes with domatia in axils of secondary and occasionally tertiary veins, margins rarely sinuate-undulate or lyrate; stipules persistent or infrequently caducous, interpetiolar, united around stem, or fused to petioles, triangular, entire. Inflorescences terminal, axillary, or leaf-opposed, capitate with 1 to several hemispherical to subglobose heads, these fasciculate or cymose, few to many flowered, pedunculate or sessile, bracteate or bracts reduced. Flowers sessile, shortly to fully fused by their ovaries [to free or nearly so], bisexual and distylous, rarely bisexual and monomorphic, or rarely dioecious. Calyx limb truncate to sinuate or rarely in 1–3 flowers of an inflorescence with 1 petaloid calycophyll (*Morinda citrifolia*). Corolla white or pink, funnellform, salverform, or campanulate, inside glabrous or pubescent in throat, [tube sometimes fenestrate]; lobes 3–7, valvate in bud. Stamens 3–7, inserted in corolla throat or tube, exerted or included; filaments short; anthers dorsifixed, sometimes with connective prolonged into an apical appendage. Ovary 2-celled with ovules 2 in each cell, or incompletely to completely 4-celled due to secondarily formed false septa with ovules 1 in each cell, ovules attached to septum near base; stigmas 2, linear, exerted or included. Fruit multiple with entire fruiting heads comprising one fruit (i.e., drupeletum) [sometimes fruit simple]; individual fruit drupaceous, fleshy, generally obovoid, blue to black, with calyx limb persistent; pyrenes 2–4, 1-locular, with 1 seed, cartilaginous or bony, subtrigonal to plano-convex, adaxially (i.e., ventrally) flat or sulcate; seeds medium-sized, subtrigonal or ellipsoid; endosperm abundant, corneous; embryo small; cotyledons oblong; radicle inferior.

About 80–100 species: widespread in tropical and subtropical regions worldwide; 27 species (18 endemic) in China.

*Morinda* includes a notable range of breeding systems (Johansson, Opera Bot. 122: 1–167. 1994), but most of the species are apparently distylous, with the anthers and stigmas separated and their positions reciprocal between the short-styled and long-styled form of the same species; however, this biology has been sometimes overlooked. Also, as noted by Johansson (loc. cit.), the position of the inflorescences, in particular terminal vs. leaf-opposed, deserves careful observation and aids identification of species. In particular, the leaf-opposed inflorescences often are produced on the terminal node, then later displaced by subsequent growth from the axil of that leaf, and can be confused with true terminal inflorescences that have two subtending leaves. The inflorescences with “fasciculate to umbellate” peduncles actually appear to be condensed cymes or racemes, with the peduncles arising from a very shortly prolonged structure at the stem apex that also bears several stipuliform bracts, usually one above the other. The twining Asian species apparently share having their lateral branches surrounded at the base (i.e., at the divergence from main stem) by persistent leafless stipules. Some species of *Morinda* have petaloid bracts or possibly calyx lobes; this character appears to vary within some individual species. Y. Z. Ruan’s (in FRPS 71(2): 179–202. 1999) taxonomy of *Morinda* distinguished species based on different characters, in particular pubescence, leaf shape, peduncle length compared across developmental stages, drying color and texture, pattern of tertiary leaf veins on dried specimens, and degree of fusion of flowers, than used by many other authors (e.g., Johansson, loc. cit.; Springate et al., Fl. Bhutan 2(2): 804. 1999).

- 1a. Erect trees or shrubs; inflorescences terminal, axillary, or leaf-opposed, 1 or 2 per node.
  - 2a. Plants of seashores and low elevations, 0–50 m; leaves with 5–7 pairs of secondary veins; fruit 2.5–5 cm in diam. .... 6. *M. citrifolia*
  - 2b. Plants of terrestrial inland habitats, 500–1400 m (exact elevation unknown in *M. leiantha*).
    - 3a. Inflorescences terminal and/or axillary.
      - 4a. Stems hirtellous, hispidulous, or subglabrous; leaves with secondary veins 5–8 pairs; peduncles 0.2–0.5 cm; corollas with tubes ca. 20 mm and lobes ca. 4 mm ..... 13. *M. leiantha*
      - 4b. Stems glabrous or subglabrous; leaves with secondary veins 8–10 pairs; peduncles ca. 2 cm; corollas with tubes ca. 32 mm and lobes ca. 13 mm ..... 15. *M. longissima*
    - 3b. Inflorescences leaf-opposed.
      - 5a. Stems glabrous to pubescent; leaves pubescent abaxially, with secondary veins 7–10 pairs; peduncles 0.1–0.3 cm ..... 19. *M. persicifolia*
      - 5b. Stems glabrous; leaves glabrous abaxially, with secondary veins 9–24 pairs; peduncles 1–6 cm.
        - 6a. Leaves 4–5.5 cm wide, with secondary veins 12–24 pairs; corollas with tubes 15–18 mm, lobes 3–4 mm ..... 26. *M. undulata*
        - 6b. Leaves 5–11 cm wide, with secondary veins 9–14 pairs; corollas with tubes 16–33 mm, lobes 4–15 mm.

- 7a. Petioles 0.5–1 cm; corollas with tubes 16–33 mm, lobes 4–15 mm; fruit ca. 2.5 cm in diam. .... 1. *M. angustifolia*
- 7b. Petioles 2–4 cm; corollas with tubes ca. 22 mm, lobes ca. 4 mm; fruit ca. 1 cm in diam. .... 21. *M. rosiflora*
- 1b. Lianas, twiners, or shrubs; inflorescences terminal, with heads solitary or in groups of 2–11.
- 8a. Calyx limb developed, 1–2.5 mm; leaves acute to obtuse, rounded, truncate, or cordulate at base.
- 9a. Stems and leaves glabrous ..... 10. *M. howiana*
- 9b. Stems and leaves glabrous to densely hirtellous or pilosulous, with pubescence present at least on veins abaxially on young leaves.
- 10a. Stems and leaves sparsely to moderately puberulent to glabrescent; corollas with tubes and lobes ± equal, tube 3–4 mm, lobes 3–4 mm; fruit 0.5–1.1 cm in diam. .... 17. *M. officinalis*
- 10b. Stems and leaves abaxially densely hirtellous or pilosulous; corollas with lobes longer than tube, tube 1–2 mm, lobes 3–4.5 mm; fruit 1–2 cm in diam.
- 11a. Leaves with 7–10 pairs of secondary veins; corollas with tubes 1.5–2 mm and lobes 4–4.5 mm; calyx lobes narrowly triangular, acute ..... 8. *M. cochinchinensis*
- 11b. Leaves with 10–13 pairs of secondary veins; corollas with tubes 1–1.2 mm and lobes 3–4 mm; calyx lobes rounded to obtuse ..... 27. *M. villosa*
- 8b. Calyx limb reduced to shortly developed, less than 1 mm; leaves acute to cuneate, obtuse, or rounded at base.
- 12a. Leaves rugulose; corolla tube ca. 10 mm ..... 22. *M. rugulosa*
- 12b. Leaves flat, smooth; corolla tube 1–3 mm or 12–25 mm.
- 13a. Corolla tube 12–25 mm.
- 14a. Corolla tube 12–20 mm.
- 15a. Young stems densely ferruginous hirtellous when dry; leaves drying leathery and abaxially whitened ..... 5. *M. cinnamomifoliata*
- 15b. Young stems densely puberulent, strigillose, or hirtellous with pubescence drying colorless; leaves drying papery to membranous and abaxially golden yellow or brownish yellow ..... 7. *M. citrina*
- 14b. Corolla tube ca. 25 mm.
- 16a. Leaves glabrous throughout ..... 3. *M. brevipes*
- 16b. Leaves sparsely to densely pubescent at least abaxially on veins.
- 17a. Stems puberulent with trichomes drying colorless, to glabrescent ..... 2. *M. badia*
- 17b. Stems densely hirtellous with trichomes drying golden brown ..... 4. *M. callicarpifolia*
- 13b. Corolla tube 1–3 mm.
- 18a. Corollas with tubes and lobes ± equal in length, tube 2–2.5(–3) mm, lobes 2–2.5(–3) mm.
- 19a. Stems and leaves glabrous ..... 12. *M. lacunosa*
- 19b. Stems and leaves puberulent to hirtellous at least when young.
- 20a. Leaves drying with gray to black cast ..... 14. *M. litseifolia*
- 20b. Leaves drying with brown or yellow cast.
- 21a. Leaves drying with brown cast; corollas with tubes ca. 3 mm, lobes ca. 3 mm ..... 24. *M. shuanghuaensis*
- 21b. Leaves drying with brown, grayish brown, or yellowish brown cast; corollas with tubes 2–2.5 mm, lobes 2–2.5 mm.
- 22a. Petioles 0.4–0.8 cm; leaves adaxially sparsely hispidulous to glabrescent ..... 11. *M. hupehensis*
- 22b. Petioles 0.5–1.5 cm; leaves adaxially sparsely hirtellous, subglabrous, or glabrous ..... 23. *M. scabrifolia*
- 18b. Corollas with lobes longer than tubes by 50% or more, tube 1–2 mm, lobes 2–4 mm.
- 23a. Leaves drying with gray to black cast; stems densely yellowish, clear, or ferruginous strigillose or hirtellous ..... 9. *M. hainanensis*
- 23b. Leaves drying with green, brown, yellow, or reddish cast; stems moderately to sparsely hirtellous, hispidulous, or puberulent with colorless trichomes, to subglabrous.
- 24a. Leaves drying with yellow or reddish cast.
- 25a. Leaves 2–7 × 0.3–3 cm, cuneate to acute at base; corolla lobes 3–4 mm ..... 18. *M. parvifolia*
- 25b. Leaves 7–13 × 2–4 cm, cuneate to obtuse or rounded at base; corolla lobes ca. 2 mm ..... 20. *M. pubiofficialis*
- 24b. Leaves drying with brown, grayish brown, or greenish cast.
- 26a. Leaves with secondary veins 4 or 5 pairs; peduncles 0.4–1.1 cm; fruit 0.4–0.8 cm in diam. .... 16. *M. nanlingensis*

- 26b. Leaves with secondary veins 5–7 pairs; peduncles 1–1.5 cm; fruit 0.7–1.2 cm in diam. .... 25. *M. umbellata*

**1. *Morinda angustifolia*** Roxburgh, Pl. Coromandel 3: 32. 1815.

黄木巴戟 huang mu ba ji

Erect shrubs or small trees, ca. 6 m tall; branches quadrangular, glabrous. Leaves opposite, or solitary opposite an inflorescence; petiole 0.5–1 cm, glabrous; blade drying papery, matte on both surfaces, brownish green, elliptic-oblong, elliptic, oblong-lanceolate, or oblanceolate, 15–30 × 6–10 cm, adaxially glabrous, abaxially scabrous to glabrous or sometimes sparsely hirtellous on veins, base acute to attenuate, apex acute to acuminate; secondary veins 9–13 pairs; stipules interpetiolar, free or shortly united to petioles, triangular, 4.5–5 mm, acuminate or acute. Inflorescence solitary and leaf-opposed; peduncle 1.5–4 cm; flowering head 1, subglobose to cylindrical, many flowered, 0.8–2.5 cm (not including corollas); bracteoles subulate. Flowers fused only shortly at base, distylous. Calyx glabrous; limb truncate to denticulate, ca. 1 mm. Corolla white, salverform, outside glabrous; tube cylindrical to slenderly funnel-form, 16–33 mm; lobes 5, ovate-lanceolate, 4–15 mm, acute. Ovary 4-celled. Drupecetum mulberry-shaped, subglobose, or ellipsoid-oblong, to 2.5 cm in diam. Drupes partially fused to nearly separate, white or black, obovoid to subglobose, 10–15 mm. Fl. Apr–May, fr. summer–autumn.

Forests; 500–1400 m. S Yunnan [Bhutan, India, Laos, Myanmar, Nepal, Thailand].

The inflorescences are indeterminate and begin flowering with ± a dozen developed buds; the flowers continue to be produced through growth at the top of the spike while the fruit are developing on the lower parts, thus the older inflorescences become cylindrical or oblong in shape. Y. Z. Ruan (in FRPS 71(2): 185. 1999) described the inflorescence position as consistently leaf-opposed at the terminal node; however, inflorescences can also be found along the stem well below its apex (e.g., *Tsi Zhanhou 92-130*, MO), and the infructescences are usually found along the stem well below the apex (e.g., Puff et al., Rubiaceae of Thailand, 113. 2005).

**2. *Morinda badia*** Y. Z. Ruan, Fl. Reipubl. Popularis Sin. 71(2): 327. 1999.

栗色巴戟 li se ba ji

Lianas; branches at base with persistent leafless stipules, when young puberulent and terete, becoming glabrescent, angled, dark brown or purplish blue. Leaves opposite; petiole 4–8 mm, densely hirtellous; blade drying papery, adaxially brownish black, abaxially ferruginous, elliptic-oblong, elliptic-lanceolate, or oblanceolate, 7–12 × 2–4 cm, adaxially shiny and hirtellous or glabrescent, abaxially hirtellous at least along veins, base cuneate to attenuate, apex acuminate; secondary veins 4–6 pairs; stipules fused into a tube, 2–5 mm, truncate. Inflorescence terminal; peduncles 3–5, umbellate, 5–18 mm, hirtellous; heads 1 per peduncle, 3–10-flowered. Flowers fused at base, biology not noted. Calyx limb reduced, truncate or often with 1–3 teeth in outermost flowers of head. Corolla yellowish white; tube ca. 2.5 mm; lobes 4 or 5, narrowly oblong,

apically thickened and rostrate. Drupecetum subglobose, 0.5–0.8 cm in diam. Drupes fused, orange. Fl. Jun, fr. Oct.

• Forests on mountains, thickets at watersides. Guangdong (Guangzhou), Guangxi, Hainan, Hunan.

**3. *Morinda brevipes*** S. Y. Hu, J. Arnold Arbor. 32: 399. 1951.

短柄鸡眼藤 duan bing ji yan teng

Lianas; young branches densely hirtellous or pilosulous, becoming glabrous, brown. Leaves opposite; petiole 3–10 mm, puberulent or hirtellous; blade drying papery or subleathery, adaxially straw-yellow or brownish black, abaxially olive-green, brownish yellow, or brownish red, obovate-oblong, obovate, oblanceolate, lanceolate, narrowly lanceolate, or linear-lanceolate, 5–10(–13) × 0.7–3(–4) cm, glabrous on both surfaces, shiny adaxially, matte abaxially, base cuneate to acute, apex acute or acuminate; secondary veins 5–7 pairs, with foveolate or pubescent domatia; stipules fused into a tube or spathe, 2–3 mm, puberulent, hispidulous, or hirtellous, truncate, on each side with 2 bristles 0.3–1 mm. Inflorescence terminal; peduncles 4–9, fasciculate to shortly racemiform, 4–10 mm, densely puberulent, as a group sometimes subtended by 2–4 stipuliform bracts; heads 1 per peduncle, conical or cylindrical to subglobose, 4–6 mm, 6–16-flowered. Flowers fused for ca. 1/2 length of hypanthium, biology not noted. Calyx puberulent to glabrescent; limb 0.3–0.5 mm, truncate to denticulate. Corolla white, campanulate, outside glabrous; tube ca. 2.5 mm; lobes 4 or 5, narrowly oblong, ca. 3 mm, apically thickened and rostrate. Drupecetum subglobose to cylindrical, 1–1.2 cm in diam. Drupes almost fully fused, orange, subglobose, 5–8 mm. Fl. Apr–May, fr. Jul–Dec.

• Hills, mountains; 200–800 m. Hainan.

- 1a. Leaf blade obovate-oblong, obovate, oblanceolate, or lanceolate, 5–10(–13) × 2–3(–4) cm ..... 3a. var. *brevipes*  
 1b. Leaf blade narrowly lanceolate to lanceolate-linear, 7–11.5 × 0.7–1.4 cm ..... 3b. var. *stenophylla*

**3a. *Morinda brevipes* var. *brevipes***

短柄鸡眼藤(原变种) duan bing ji yan teng (yuan bian zhong)

Leaf blade obovate-oblong, obovate, oblanceolate, or lanceolate, 5–10(–13) × 2–3(–4) cm. Fl. Apr–May, fr. Jul–Dec.

• Hills, mountains; 200–800 m. Hainan.

**3b. *Morinda brevipes* var. *stenophylla*** Chun & F. C. How ex W. C. Ko, Fl. Hainan. 3: 581. 1974.

狭叶鸡眼藤 xia ye ji yan teng

Leaf blade narrowly lanceolate to lanceolate-linear, 7–11.5 × 0.7–1.4 cm. Fl. May.

• Wet places in forests on hills. Hainan.

**4. *Morinda callicarpifolia*** Y. Z. Ruan, Fl. Reipubl. Popularis Sin. 71(2): 325. 1999 [*"callicarpaefolia"*].

紫珠叶巴戟 zi zhu ye ba ji

Lianas or subshrubs; branches at base with persistent leafless stipules, when young densely golden hirtellous, becoming sparsely pubescent or subglabrous, terete or angled, brown or purplish black. Leaves opposite; petiole 7–10 mm, densely golden hirtellous; blade drying papery, adaxially brownish black, abaxially brown, obovate-oblong, oblong-lanceolate, or elliptic, 7–14 × 2.5–4 cm, adaxially sparsely hirtellous or hispidulous, abaxially sparsely hispidulous or hirtellous, or glabrous, on both surfaces pubescence denser along midrib, base cuneate to acute, apex acuminate, long acuminate, or obtuse then abruptly mucronate; secondary veins 5–7 pairs, with pilosulous domatia; stipules fused into a tube, 3–4 mm, densely golden hispidulous or -hirtellous, subtruncate, on each side with 1 or 2 bristles. Inflorescence terminal; peduncles 4–7, umbellate or fasciculate, 6–15 mm, densely hirtellous, as a group often subtended by 1 subulate bract; heads 1 per peduncle, 2–8-flowered. Flowers fused at base, biology not noted. Calyx puberulent; limb reduced, truncate or sometimes with 1 subulate tooth. Corolla white, tubular; tube ca. 2.5 mm, densely villous inside; lobes 4, lanceolate. Drupecetum globose, 4–8 mm in diam. Drupes fused. Fl. Jun–Jul, fr. winter.

• Forests on mountains, thickets at roadsides, ditch sides, hill slopes. Guizhou, Sichuan, Yunnan.

**5. *Morinda cinnamomifoliata*** Y. Z. Ruan, Fl. Reipubl. Popularis Sin. 71(2): 336. 1999.

樟叶巴戟 zhang ye ba ji

Lianas or subshrubs; branches at base with persistent leafless stipules, when young densely ferruginous hirtellous or -pilosulous, becoming glabrescent, angled, gray or indigo. Leaves opposite; petiole 5–10 mm, densely hirtellous; blade drying leathery, adaxially grayish black, abaxially whitened, narrowly elliptic-oblong, oblong-lanceolate, or obovate-oblong, 8–11 × 2.5–3.5 cm, adaxially ± ferruginous pilosulous, abaxially hispidulous to hirtellous, base cuneate or rounded, apex acuminate or obtuse then abruptly mucronulate; secondary veins 4 or 5 (or 6) pairs; stipules united into a tube. Inflorescence terminal; peduncles 6–10, umbellate or fasciculate, 5–10 mm, ferruginous pilosulous; heads 1 per peduncle, 5–7-flowered. Flowers fused at base, biology not noted. Calyx limb reduced, truncate or denticulate. Corolla white, outside glabrescent; tube ca. 2 mm, inside densely villous; lobes 4, linear-oblong, ca. 3 mm. Drupecetum subglobose. Drupes fully fused. Fl. Jul, fr. winter.

• Thickets on slopes near villages. SE Guangxi.

**6. *Morinda citrifolia*** Linnaeus, Sp. Pl. 1: 176. 1753.

海滨木巴戟 hai bin mu ba ji

*Morinda bracteata* Roxburgh.

Evergreen shrubs or small trees, to 5 m tall, often fleshy; branches subquadrangular, glabrous. Leaves opposite or solitary opposite an inflorescence; petiole 5–20 mm, glabrous; blade fleshy, drying papery, elliptic-oblong, elliptic, or ovate, 10–25 ×

5–13 cm, glabrous and shiny on both surfaces, base acute or acuminate, apex acute to obtuse; secondary veins 5–7 pairs, with pubescent domatia; stipules interpetiolar, free or shortly fused to petioles, broadly triangular to ovate, 4–16 mm, obtuse or rounded. Inflorescence solitary and leaf-opposed; peduncle 1–1.5 cm; head 1, oblong to subglobose, 5–10 mm in diam., many flowered; bracts absent. Flowers with hypanthia partially fused, distylous. Calyx glabrous or puberulent; limb subtruncate to truncate, 0.2–0.5 mm, sometimes in 1 to numerous flowers of a head with 1(–3) calycophylls, these white, narrowly elliptic to oblanceolate, 5–16 mm, obtuse to acute. Corolla white, funnel-form, outside glabrous; tube ca. 15 mm, densely villous in throat; lobes 5, ovate-lanceolate, ca. 6 mm. Drupecetum white, irregularly ovoid to subglobose, 2.5–5 cm. Drupes not distinguishable individually. Fl. and fr. year-round.

Flat land on seashores, sparse forests; below 100 m. Guangdong, Hainan, Taiwan [?Cambodia, India, Indonesia, Japan (Bonin and Ryukyu Islands), Malaysia, Myanmar, Papua New Guinea, Philippines, Sri Lanka, Thailand, Vietnam; N Australia, Solomon Islands; introduced in tropical America and Pacific islands].

The distinctive form called *Morinda bracteata* has well-developed white calycophylls that give the plants a markedly different appearance and may function in pollination, but these two forms have generally been considered conspecific. Nelson and Elevitch (Noni, 42–43. 2006) noted that plants with bracteate inflorescences produce smaller fruit and that the cultivated plants with variegated leaves are called *M. citrifolia* 'Potteri.' Both of these forms are found in Taiwan (e.g., Yang & Chuang 11410, MO, "*citifolia*" form; Yang & Chuang 12060, MO, "*bracteata*" form). The fruit of this species are edible (though not particularly palatable) and said to have medicinal and/or tonic value; they are sold by natural food vendors under the name "noni" or "nona." This species is increasingly widely cultivated, as detailed by Nelson and Elevitch (loc. cit.).

**7. *Morinda citrina*** Y. Z. Ruan, Fl. Reipubl. Popularis Sin. 71(2): 331. 1999.

金叶巴戟 jin ye ba ji

Lianas; branches at base with persistent leafless stipules, when young densely puberulent, strigillose, or hirtellous, becoming glabrescent, angled, brown, purplish blue, or purplish black. Leaves opposite; petiole 2–6 mm, densely puberulent, hirtellous, or pilosulous; blade drying membranous to papery, adaxially gray, abaxially golden yellow or brownish yellow, matte on both surfaces, ovate-lanceolate, oblong-linear, or elliptic, 5–12 × 1.5–3 cm, adaxially sparsely to moderately puberulent, strigillose, hispidulous, or hirtellous, abaxially moderately to sparsely strigillose, puberulent, or hirtellous especially along principal veins, base cuneate to acute, apex acuminate or acute; secondary veins 4–6 pairs, with pilosulous domatia; stipules fused into a tube or spathe, 2.5–4 mm, moderately to densely strigillose to pilosulous, truncate, on each side with 1 or 2 bristles 0.3–1 mm. Inflorescence terminal; peduncles 2–5, fasciculate or umbellate, 6–8 mm, densely puberulent to pilosulous, as a group subtended by 1 or 2 stipuliform bracts; heads 1 per peduncle, hemispherical, 4–5 mm in diam., 1–5-flowered. Flowers fused at base or for up to half of hypanthium, biology not noted. Calyx strigillose, puberulent, or glabrescent; limb 0.3–0.5 mm, truncate. Corolla white, salverform, outside densely puberulent; tube 1.2–2 mm, inside villous; lobes 4 (or 5), narrowly oblong to lanceolate, 2.5–3 mm, apically thickened and

rostrate. Drupecetum subglobose to obovate, 8–12 mm in diam. Drupes fully fused, orange, subglobose, 3–5 mm. Fl. Apr–Jul, fr. Oct–Nov.

• Forests or thickets on mountains; 500–1300 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hunan, Jiangxi, Zhejiang.

- 1a. Older leaves usually drying greenish, sometimes brown, or rarely yellow, usually not hirsutulous but rather thin and sparsely hairy along midrib ..... 7a. var. *chlorina*  
 1b. Older leaves usually drying golden yellow or brownish yellow, hirtellous especially along midrib ..... 7b. var. *citrina*

**7a. *Morinda citrina* var. *chlorina*** Y. Z. Ruan, Fl. Reipubl. Popularis Sin. 71(2): 332. 1999.

白蕊巴戟 bai rui ba ji

Older leaves usually drying greenish, sometimes brown, or rarely yellow, usually not hirsutulous but rather thin and sparsely hairy along midrib.

• Forests or thickets on mountains. Anhui, Fujian, Guangxi, Guizhou, Hunan, Jiangxi, Zhejiang.

**7b. *Morinda citrina* var. *citrina***

金叶巴戟(原变种) jin ye ba ji (yuan bian zhong)

Older leaves usually drying golden yellow or brownish yellow, hirtellous especially along midrib. Fl. Apr–Jul, fr. Oct–Nov.

• Sparse or dense forests on mountains; 500–1300 m. Guangdong, Guangxi, Guizhou, Hunan.

**8. *Morinda cochinchinensis*** Candolle, Prodr. 4: 449. 1830.

大果巴戟 da guo ba ji

*Morinda trichophylla* Merrill.

Lianas; branches at base with persistent leafless stipules, when young densely ferruginous- or yellow villosulous, terete to weakly quadrangular. Leaves opposite; petiole 3–10 mm, densely villosulous; blade drying papery, yellowed, matte to shiny adaxially, matte abaxially, elliptic, elliptic-oblong, obovate-oblong, or oblanceolate, 5.5–14 × 2–6 cm, adaxially sparsely strigose to strigillose, abaxially densely ferruginous- or yellow hirtellous to villosulous with pubescence denser along veins, base rounded to truncate, subcordate, or cordulate, apex caudate-acuminate or shortly acuminate; secondary veins 7–10 pairs, with pilosulous domatia; stipules fused into a tube or spathe, 5–9 mm, densely hispidulous to hispid, broadly triangular to truncate, on each side with 2 bristles 1–4 mm, usually quickly deciduous. Inflorescence terminal; peduncles 3–12, fascicled or umbellate, 1–3 cm, densely ferruginous- or yellow hirtellous, as a group subtended by 2 to several bracts 1–3 mm, 2- to several lobed; heads 1 per peduncle, subglobose, 5–6 mm in diam., 5–15-flowered; bracteoles linear, 0.2–1 mm. Flowers with hypanthia partially fused, biology not noted. Calyx with hypanthium portion densely strigose to strigillose; limb 1–2.5 mm, puberulent to strigillose, lobed for ca. half, lobes 4 or 5, narrowly triangular, 1–2 mm, sometimes unequal on an in-

dividual flower, often reflexed. Corolla white, rotate to salverform, outside hirtellous, pilosulous, or glabrescent, inside densely villous throughout tube and onto lobes; tube 1.5–2 mm; lobes 4 or 5, narrowly oblong to lanceolate, 4–4.5 mm, apically thickened and rostrate. Drupecetum subglobose, oblong-globose, or irregular, 1–2 cm in diam., with peduncles elongating to 4 cm. Drupes mostly fused, orange-yellow to orange-red, subglobose, 4–6 mm. Fl. May–Jul, fr. Jul–Nov.

Forests or thickets on mountain slopes, in valleys, or at stream-sides or roadsides; 100–1200 m. Fujian, Guangdong, Guangxi, Hainan [Vietnam].

The names *Morinda umbellata* and *M. villosa* were synonymized with *M. cochinchinensis* by Merrill and Chun (Sunyatsenia 1(1): 80–81. 1930) but were separated by Y. Z. Ruan (in FRPS 71(2): 187, 190. 1999) as provisionally treated here.

**9. *Morinda hainanensis*** Merrill & F. C. How, Sunyatsenia 5: 188. 1940.

海南巴戟 hai nan ba ji

Lianas; branches at base with persistent leafless stipules, when young densely yellow-, clear-, or ferruginous strigillose to -hirtellous, becoming scabrous to glabrescent, brownish gray. Leaves opposite; petiole 5–11 mm, densely villosulous to hirtellous; blade drying papery, matte and gray on both surfaces, narrowly elliptic, elliptic-oblong, oblong-lanceolate, or linear-lanceolate, 5–9 × 1.2–2.5 cm, adaxially sparsely strigillose to hirtellous, abaxially densely villosulous, pilosulous, or sericeous, base acute or attenuate, apex acute to acuminate; secondary veins 6–9 pairs, with pilosulous domatia; stipules fused into a tube or spathe, 2.5–6 mm, pilosulous to hirtellous, on each side with 2 bristles 0.2–1 mm. Inflorescence terminal; peduncles 3–9, fasciculate to umbellate, 5–10 mm, densely sericeous to strigillose, as a group sometimes subtended by 1 or 2 linear bracts 0.5–1 mm; heads 1 per peduncle, hemispherical, 3–4 mm in diam., 3–8-flowered. Flowers fused at base, apparently distylous. Calyx with hypanthium puberulent to densely strigillose; limb 0.5–0.8 mm, glabrescent, truncate. Corolla salverform, outside puberulent to pilosulous, inside densely villous in upper part of tube and onto lobes; tube ca. 1 mm; lobes 4, narrowly lanceolate, ca. 2 mm, apically thickened and rostrate. Drupecetum subglobose or compressed globose, 6–8 mm in diam. Drupes fully fused, subglobose, ca. 3 mm. Fl. May, fr. May.

• Wet places under dense forests on hills; ca. 900 m. Hainan.

**10. *Morinda howiana*** S. Y. Hu, J. Arnold Arbor. 32: 400. 1951.

糠藤 kang teng

Lianas; branches at base with persistent leafless stipules, glabrous, terete, drying brown. Leaves opposite; petiole 6–10 mm, glabrous to puberulent; blade drying thinly to thickly papery, adaxially shiny and reddish dark brown, abaxially matte to somewhat shiny and reddish brown, elliptic, elliptic-lanceolate, or oblong, 6–14 × 2–6 cm, glabrous, base rounded, cuneate, or acute, apex acute to acuminate; secondary veins 6–9 pairs, with pilosulous domatia; stipules fused into a tube, 5–15 mm, puberulent to glabrous, truncate, on each side with 2 bristles 0.2–1

mm. Inflorescence terminal; peduncles 5–10, fasciculate to umbellate, 8–18 mm, puberulent, as a group subtended by several triangular to bifid bracts 1–2 mm; heads 1 per peduncle, subglobose to hemispherical, 4–6 mm in diam., 4–12-flowered. Flowers fused only shortly at base, biology not noted. Calyx puberulent to glabrescent; limb ca. 1 mm, truncate, sinuate, or shallowly lobed; lobes rounded, ciliolate. Corolla subcampanulate, puberulent outside; tube ca. 2 mm, inside densely villous in upper part and throat; lobes 4 or 5, narrowly oblong to lanceolate, ca. 2 mm, apically thickened and rostrate. Drupecetum subglobose to obovate, 8–14 mm in diam. Drupes fully fused, subglobose, 4–5 mm. Fl. Apr–May, fr. Jul–Oct.

• Forests in valleys and at streamsides, thickets at roadsides or on hill slopes; 300–700 m. Guangdong (Yangjiang), Hainan.

The protologue commented that “the presence of bristles on the glabrous capitulum is also very characteristic,” but these bristles are apparently small bracts, which are now also known from several other Chinese species of *Morinda*.

**11. *Morinda hupehensis*** S. Y. Hu, J. Arnold Arbor. 32: 400. 1951.

湖北巴戟 hu bei ba ji

Lianas; branches at base surrounded by persistent leafless stipules, when young densely white hirtellous, white puberulent, ferruginous hirtellous, or glabrescent, becoming angled, purplish blue. Leaves opposite; petiole 4–8 mm, densely hirtellous; blade drying papery, matte on both surfaces, adaxially greenish brown, abaxially coffee-colored or brownish black, oblanceolate, elliptic-lanceolate, elliptic-oblong, or linear-oblong, 5–9 × 1.5–3 cm, adaxially sparsely hispidulous to glabrescent, abaxially ferruginous hirtellous, yellow hirtellous, or brownish gray hirtellous, base cuneate, obtuse, or acute, apex acuminate or sometimes obtuse then abruptly mucronulate; secondary veins 5–7 pairs, with pilosulous domatia; stipules frequently deciduous through fragmentation, fused into a tube or spathe, 2.5–5 mm, pilosulous to hirtellous, truncate, on each side with 2 bristles 0.2–0.5 mm. Inflorescence terminal; peduncles 4–9, fasciculate to umbellate, 5–15 mm, densely puberulent to pilosulous, as a group subtended at base by 1–4 stipuliform bracts; heads 1 per peduncle, 4–7-flowered. Flowers with hypanthia partially fused, biology not noted. Calyx puberulent to glabrescent; limb reduced, truncate or sinuate-undulate. Corolla white; tube ca. 2.5 mm, densely villous inside; lobes 4 or 5, ca. 2.5 mm. Drupecetum subglobose, 4–10 mm in diam. Drupes fully fused, red, subglobose, 4–5 mm. Fl. Jul–Aug, fr. Oct–Nov.

• Forests, thickets at forest margins; 400–1000 m. Fujian, Guangxi, Guizhou, Hubei, Hunan, Sichuan.

**12. *Morinda lacunosa*** King & Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 73: 87. 1903.

长序羊角藤 chang xu yang jiao teng

Lianas, to 20 m tall; branches when young terete, glabrous, becoming angled, brownish gray. Leaves opposite; petiole 8–20 mm, glabrous; blade drying thinly papery or subleathery, adaxially brownish black, abaxially dark brownish red, elliptic, elliptic-lanceolate, or ovate-oblong, 10–16 × 3–7 cm, glabrous, base cuneate, apex acuminate or acute; secondary

veins 6 or 7 pairs, with pilosulous foveolate domatia; stipules caducous, interpetiolar or fused into a spathe or tube, 3–17 mm, glabrous, obtuse, rounded, or truncate. Inflorescence terminal, pilosulous [to perhaps glabrous]; peduncles 1–3, 0.5–8 cm, terminating in 1 head or 6–20 rays 0.8–2 cm and subtended by linear bracts 1–3 mm; heads several, subglobose, 8–10 mm in diam., 6–20-flowered. Flowers fused for half or more of hypanthium, biology not noted. Calyx glabrous; limb reduced, truncate to shallowly 4-dentate. Corolla white, subcampanulate; tube 2–2.5 mm, villous in upper part inside; lobes 4, 2–2.5 mm. Drupecetum subglobose to obovate, 4–11 mm in diam. Fl. Jun, fr. Dec.

Shady places in forests at streamsides or roadsides; 1000–1100 m [to only ca. 700 m in Thailand]. Yunnan [Malaysia, Thailand].

**13. *Morinda leiantha*** Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 41: 313. 1872.

顶花木巴戟 ding hua mu ba ji

Erect shrubs or small trees; branches hirtellous or subglabrous, angled, dark brown. Leaves opposite; petiole 0.5–1(–3) cm; blade drying thinly papery, matte and dark brown on both surfaces, oblong-lanceolate, narrowly lanceolate, rhombic-lanceolate, or oblanceolate, 8–14(–20) × 2–5 cm, adaxially glabrous or pilosulous, abaxially scabrous, glabrous, or pilosulous along veins, base acute to attenuate, apex acuminate; secondary veins 5–8 pairs; stipules ovate-triangular to ovate-lanceolate, acute or 2-lobed. Inflorescence terminal or axillary; peduncle 2–5 mm, often with 2–4 branches, each with 1 capitulum; capitulum ellipsoid-oblong, many flowered. Flowers partially fused, each with 3–5 bracts in a whorl, biology not noted. Calyx limb truncate. Corolla white, salverform, outside glabrous; tube ca. 20 mm, inside glabrous; lobes 5, lanceolate, ca. 4 cm. Young drupelet mulberry-shaped. Fl. and fr. year-round.

Forests on hill slopes, shady thickets. S Yunnan [Myanmar].

**14. *Morinda litseifolia*** Y. Z. Ruan, Fl. Reipubl. Popularis Sin. 71(2): 335. 1999.

木姜叶巴戟 mu jiang ye ba ji

Lianas or subshrubs; branches at base surrounded by persistent leafless stipules, when young sparsely puberulent, becoming glabrescent, purplish black. Leaves opposite; petiole 4–6 mm, hirtellous; blade drying membranous or papery, adaxially gray, grayish green, or grayish black, abaxially brownish gray or greenish red, linear, oblong-linear, lanceolate-linear, oblanceolate, or elliptic-oblanceolate, 5–11 × 1.5–2(–3) cm, adaxially glabrous or sparsely pilosulous, abaxially usually glabrous except hirtellous along veins, base cuneate to acute, apex acuminate or acute; secondary veins 4–6; stipules fused into a spathe or tube, ca. 4 mm. Inflorescences terminal; peduncles 3–5, fasciculate or umbellate, ca. 7 mm, puberulent; heads 1 per peduncle, subglobose, 5–7-flowered. Flowers fused at base, biology not noted. Calyx limb reduced, truncate. Corolla yellowish white; tube ca. 2 mm, densely villous inside; lobes 4 or 5, ca. 2 mm. Drupecetum subglobose, 2–8 mm in diam. Drupes almost fully fused. Fl. Jul, fr. Oct–Nov.

• Sparse or dense forests on mountains; 700–1300 m. Fujian, Guangxi, Hunan, Jiangxi, Sichuan.

**15. *Morinda longissima*** Y. Z. Ruan, Fl. Reipubl. Popularis Sin. 71(2): 323. 1999.

大花木巴戟 da hua mu ba ji

Erect shrubs, to 2 m tall; branches glabrous or subglabrous, subquadrangular, green or pale green. Leaves opposite, sometimes crowded at ends of branches; petiole 2–3 cm, glabrous or subglabrous; blade drying submembranous to membranous, pale green and matte on both surfaces, oblong-oblancheolate, oblong-lanceolate, or oblanceolate, 13–23 × 6–10 cm, glabrous or pilosulous abaxially, base cuneate to attenuate, margin sometimes weakly repand or sinuate, apex acuminate or obtuse then abruptly acuminate; secondary veins 8–10 pairs, apparently without domatia; stipules interpetiolar, ovate, semicircular, or subcordate, acute or 2-lobed. Inflorescence terminal or axillary; peduncle 1, ca. 2 cm, glabrous; heads 1 per peduncle, subglobose, many flowered; bracts encircling flowers in 1 or 2 whorls, 3–6 per whorl, subulate. Flowers shortly fused at base, biology not noted. Calyx limb truncate to sinuate. Corolla white, slenderly funnelliform to salverform, glabrous outside; tube ca. 32 mm, glabrous inside; lobes 5, lanceolate to ligulate, ca. 13 mm. Infructescences and fruit unknown. Fl. Apr–May.

- Sparse forests, shady thickets; ca. 700 m. S Yunnan.

The bracts arranged in whorls subtending the flowers are notable and probably distinctive for the species; however, these bracts are not shown in the illustrations of this species in the protologue nor in the additional figure presented in the FRPS *Morinda* treatment (Y. Z. Ruan, loc. cit.: 184, t. 46, f. 5).

**16. *Morinda nanlingensis*** Y. Z. Ruan, Fl. Reipubl. Popularis Sin. 71(2): 329. 1999.

南岭鸡眼藤 nan ling ji yan teng

Lianas or subshrubs; branches surrounded at base by persistent leafless stipules, when young hirtellous or hispidulous, becoming glabrescent, angled, purplish blue. Leaves opposite; petiole 3–5 mm, hirtellous; blade drying papery, adaxially greenish brown or dark brown, abaxially brownish gray, obovate, elliptic-oblancheolate, elliptic, or rhombic-lanceolate, rarely dimorphic, 4–9(–12) × 1.5–3.5 cm, adaxially pilosulous to glabrescent, abaxially glabrous to densely hirtellous at least on principal veins, base cuneate, apex acute, acuminate, or obtuse then abruptly mucronulate; secondary veins 5–7 pairs; stipules fused into a tube, truncate. Inflorescence terminal; peduncles 7–10, umbellate or fasciculate, 10–15 mm, pilosulous; heads 1 per peduncle, 3–11-flowered. Flowers fused at base, biology not noted. Calyx limb reduced, truncate or perhaps sometimes with 1 calycophyll. Corolla campanulate, mealy puberulent outside; tube ca. 2 mm, internally densely bearded; lobes 4 or 5, sublancheolate, ca. 3 mm. Drupecetum subglobose, 4–8 mm in diam. Drupes orange or dark. Fl. Jun, fr. Oct.

- Shady places, forests, thickets on mountains, hills. Guangdong, Guangxi, Hunan, Yunnan, Zhejiang.

- 1a. Flowering heads with 3 or 4(–7) flowers; leaf blade rhombic-lanceolate, 4–7 × 1.5–2 cm ..... 16b. var. *pauciflora*
- 1b. Flowering heads with 5–11 flowers; leaf blade obovate, elliptic-oblancheolate, or elliptic, 7–12 × 2–3.5 cm.

- 2a. Leaf blade glabrous abaxially ..... 16a. var. *nanlingensis*
- 2b. Leaf blade densely pilosulous abaxially ..... 16c. var. *pilophora*

**16a. *Morinda nanlingensis* var. *nanlingensis***

南岭鸡眼藤(原变种) nan ling ji yan teng (yuan bian zhong)

Leaf blade obovate, elliptic-oblancheolate, or elliptic, 7–9(–12) × 2–3.5 cm, glabrous abaxially. Flowering heads 5–11-flowered. Fl. Jun, fr. Oct.

- Shady places at streamsides in forests, thickets on mountains. Guangdong, Guangxi, Hunan, Yunnan.

**16b. *Morinda nanlingensis* var. *pauciflora*** Y. Z. Ruan, var. nov.

少花鸡眼藤 shao hua ji yan teng

Type: China. Zhejiang: Hangzhou, X. Y. He 20528 (holotype, IBSC).

Validating Latin diagnosis: that of “*Morinda nanlingensis* Y. Z. Ruan va. [sic!] *pauciflora* Y. Z. Ruan” (Y. Z. Ruan in W. C. Chen, Fl. Reipubl. Popularis Sin. 71(2): 331. 1999).

Leaf blade rhombic-lanceolate, 4–7 × 1.5–2 cm. Flowering heads 3- or 4(–7)-flowered.

- Forests on hills. S Zhejiang.

This name was previously published by Y. Z. Ruan (loc. cit.) but not validly so because the herbarium in which the type is conserved was not specified (*Vienna Code*, Art. 37.7).

**16c. *Morinda nanlingensis* var. *pilophora*** Y. Z. Ruan, Fl. Reipubl. Popularis Sin. 71(2): 331. 1999.

毛背鸡眼藤 mao bei ji yan teng

Leaf blade obovate, elliptic-oblancheolate, or elliptic, 7–9(–12) × 2–3.5 cm, abaxially densely pilosulous. Flowering heads 5–11-flowered.

- Forests, shady thickets on mountains. Guangxi, Hunan.

**17. *Morinda officinalis*** F. C. How, Acta Phytotax. Sin. 7: 326. 1958.

巴戟天 ba ji tian

Lianas; branches surrounded at base by persistent leafless stipules, when young strigillose, hirtellous, or pilose, becoming glabrescent and scabrous, angled, brown or bluish black. Leaves opposite; petiole 4–11 mm, densely puberulent, strigillose, hirtellous, or hirsute to glabrescent; blade drying papery, on both surfaces brown to yellow-brown, shiny to matte adaxially, matte abaxially, ovate-oblong, obovate-oblong, or elliptic, 6–13 × 3–6 cm, adaxially sparsely strigillose, hirtellous, or hirsute to glabrescent, abaxially glabrous or sparsely hirtellous along principal veins, base obtuse, rounded, cuneate, or acute, apex acute, obtuse, or rounded and abruptly mucronulate; secondary veins (4 or) 5–7 pairs, with small pilosulous domatia; stipules fused into a spathe or tube, 3–5 mm, membranous, puberulent to hirtellous, truncate, on each side 2-denticulate. Inflorescence terminal; peduncles 1–7 or 15–25, umbellate or fasciculate, 0.1–1

cm, densely hirtellous to strigillose, as a group usually subtended by 1 or 2 stipuliform bracts; heads 1 per peduncle, subglobose to hemispherical, 5–7 mm in diam., 1–3- or 4–10-flowered. Flowers fused for ca. half of hypanthium, biology not noted. Calyx puberulent to glabrous; limb 1–1.5 mm, lobed for ca. 1/2; lobes 2–4, triangular, sometimes markedly unequal on an individual flower, obtuse to acute. Corolla white, campanulate or urceolate, outside puberulent, hirtellous, or glabrescent; tube 3–4 mm, inside densely villosulous from middle of tube to throat; lobes (2–)4, lanceolate or narrowly oblong, 3–4 mm, apically thickened and rostrate. Drupecetum globose to obovate, 5–11 mm in diam. Drupes fully fused, red, subglobose, 4–5 mm. Fl. May–Jul, fr. Oct–Nov.

• Sparse or dense forests and thickets on mountains, also cultivated; 100–500 m. Fujian, Guangdong, Guangxi, Hainan.

According to the protologue, the species is apparently cultivated and used medicinally. The roots were described by Y. Z. Ruan (in FRPS 71(2): 199. 1999) as fleshy, irregularly intestine-like constricted, slightly purplish red, purplish blue when dry; they are illustrated in the protologue figure. The roots of almost no other *Morinda* species have been described by Y. Z. Ruan or any other authors seen.

- 1a. Flowering heads 15–25, each with 1(–3) flowers; peduncles ca. 2 mm; calyx lobes often becoming white ..... 17c. ‘Uniflora’
- 1b. Flowering heads 1–10, each with 4–10 flowers; peduncles 1–10 mm; calyx lobes green.
- 2a. Young branches and leaf blades abaxially sparsely hirtellous, puberulent, or hirsute to glabrescent ..... 17b. var. *officinalis*
- 2b. Young branches and leaf blades densely transparent villous ..... 17a. var. *hirsuta*

**17a. *Morinda officinalis* var. *hirsuta*** F. C. How, Acta Phytotax. Sin. 7: 328. 1958.

毛巴戟天 *mao ba ji tian*

Young branches and leaf blade densely transparent villous. Flowering heads 1–10, 4–10-flowered; peduncles 1–10 mm. Calyx lobes green.

• Forests on mountains. Hainan.

**17b. *Morinda officinalis* var. *officinalis***

巴戟天(原变种) *ba ji tian (yuan bian zhong)*

Young branches and leaf blades adaxially sparsely hirtellous, puberulent, or hirsute to glabrescent. Flowering heads 1–10, 4–10-flowered; peduncles 1–10 mm. Calyx lobes green. Fl. May–Jul, fr. Oct–Nov.

• Sparse or dense forests and thickets on mountains. Fujian, Guangdong, Guangxi, Hainan.

**17c. *Morinda officinalis* ‘Uniflora’**

密梗巴戟天 *mi geng ba ji tian*

Flowering heads 15–25, 1(–3)-flowered; peduncles ca. 2 mm. Calyx lobes often becoming white.

• Cultivated in Guangdong.

This taxon was originally published as a cultivar (Y. Z. Ruan in W. C. Chen, Fl. Reipubl. Popularis Sin. 71(2): 337. 1999), but it was not made clear if it is a well-known form that is deliberately selected and propagated or a wild-encountered form.

**18. *Morinda parvifolia*** Bartling ex Candolle, Prodr. 4: 449. 1830.

鸡眼藤 *ji yan teng*

Lianas, climbing, twining, or prostrate; branches surrounded at base by persistent leafless stipules, when young glabrous, puberulent, or densely hispidulous-hirtellous, becoming weakly angled, brown to slightly purplish blue. Leaves opposite; petiole 3–8 mm, glabrous, puberulent, or hispidulous-hirtellous; blade drying papery, on both surfaces matte and yellowish green, yellowish brown, or yellowish gray, obovate, linear-oblancheolate, sublancheolate, obovate-oblancheolate, oblancheolate, or obovate-oblong, 2–5(–7) × 0.3–3 cm, both surfaces glabrous or infrequently moderately to sparsely hirsute or hirtellous, base cuneate to acute, apex acute, obtuse, or rounded and shortly abruptly acuminate or mucronulate; secondary veins 3 or 4(–6) pairs, with pilosulous domatia; stipules fused into a spathe or tube, 2–4 mm, membranous, glabrous, puberulent, or hispidulous, truncate and on each side with 1 or 2, sometimes caducous bristles 0.5–1 mm. Inflorescence terminal; peduncles (2 or)3–9, umbellate to fasciculate, 0.6–2 cm, densely puberulent to hispidulous, as a group often subtended by 1 to several stipuliform bracts; heads 1 per peduncle, subglobose, obovate, conical, or rarely cylindrical, 5–8 mm in diam., 3–15(–17)-flowered, often with 1 to several linear bracts 0.5–1 mm. Flowers fused at base, biology not noted. Calyx puberulent to glabrescent; limb 0.5–0.8 mm, truncate to sinuate or denticulate. Corolla white, campanulate, outside puberulent to glabrous; tube 1.5–2 mm, inside densely villous from middle to throat; lobes 4 or 5, narrowly oblong, 3–4 mm, apically thickened and rostrate. Drupecetum subglobose to obovate, 6–15 mm in diam. Drupes fully fused, orange, subglobose, 4–5 mm. Fl. Apr–Jun, fr. Jun–Aug.

Thickets at roadsides or ditch sides, prostrate on bare land, thickets or forests on hills; sea level to 400 m. Fujian, Guangdong, Guangxi, Hainan, Jiangxi, Taiwan [Philippines, Vietnam].

Y. Z. Ruan (in FRPS 71(2): 194. 1999) commented that leaf shape in this species varies based to some degree on ecology, with obovate and dimorphic leaves in dry, sunny, bare habitat; linear-oblancheolate or sublancheolate leaves in shady, dry, bare habitat; and obovate-oblancheolate, oblancheolate, or obovate-oblong leaves when climbing on shrubs.

**19. *Morinda persicifolia*** Buchanan-Hamilton, Trans. Linn. Soc. London 13: 535. 1822.

短梗木巴戟 *duan geng mu ba ji*

Shrubs or small trees, to 11 m tall; branches quadrangular, pubescent or glabrous. Leaves opposite or solitary opposite an inflorescence; petiole 1–2 cm; blade drying papery, adaxially gray, abaxially pale green, oblong-lanceolate, lanceolate, oblancheolate, or linear-lanceolate, 6–18 × 2–12 cm, glabrous or sparsely pilosulous, base acute to attenuate, apex acute or shortly acuminate; secondary veins 7–10 pairs; stipules inter-

petiolar, triangular to broadly triangular, acute to subulate acuminate. Inflorescence solitary and leaf-opposed; peduncle 1, 1–3 mm; head 1, many flowered; bracteoles subulate. Flower biology not noted. Calyx limb truncate. Corolla white, salverform; tube ca. 16 mm, somewhat curved, inside glabrous; lobes 5, ca. 4 mm. Drupecetum mulberry-shaped or conical-oblong, 2–2.5 × 1.5–2 cm. Fl. and fr. summer–autumn.

Sparse forests on mountains. S Yunnan [Cambodia, NE India, Indonesia, Laos, Malaysia, Myanmar, Vietnam].

**20. *Morinda pubiofficialis*** Y. Z. Ruan, Fl. Reipubl. Popularis Sin. 71(2): 334. 1999.

细毛巴戟 xi mao ba ji

Lianas or subshrubs, 2–10 m tall; branches when young sparsely hirtellous, becoming subglabrous, weakly angled, brown or pale brownish purple. Leaves opposite; petiole ca. 4 mm, hirtellous or pilosulous; blade drying papery, adaxially shiny and dark brownish red or yellowish brown, abaxially pale brownish red or brownish yellow, oblong-lanceolate, linear-lanceolate, or ovate-oblong, 7–13 × 2–4 cm, adaxially glabrous or sometimes sparsely hirtellous when young, abaxially glabrous, base cuneate or rounded, apex acute to acuminate; secondary veins 5 or 6 pairs; stipules fused into a tube, ca. 4 mm, subtruncate. Inflorescence terminal; peduncles 2–5, umbellate, 7–11 mm; heads 1 per peduncle, 3- to many flowered. Flowers fused at base, biology not noted. Calyx limb reduced, truncate. Corolla white, campanulate to weakly urceolate, outside glabrous; tube ca. 1.2 mm, inside densely bearded; lobes 4 or 5, linear, ca. 2 mm. Drupecetum subglobose, 5–10 mm in diam. Drupes fully fused, red. Fl. May–Jun, fr. Oct–Nov.

• Forests in valleys or on mountains, thickets at watersides. Guangdong, Guizhou, Hunan.

The roots were described by Y. Z. Ruan as irregularly intestine-like constricted, with fleshy cortex.

**21. *Morinda rosiflora*** Y. Z. Ruan, Fl. Reipubl. Popularis Sin. 71(2): 324. 1999.

红木巴戟 hong mu ba ji

Erect shrubs, ca. 2.5 m tall; branches glabrous, quadrangular, purplish black. Leaves opposite or solitary opposite an inflorescence; petiole 2–4 cm; blade matte on both surfaces, adaxially purplish black or purplish red, abaxially dark brown, elliptic-oblong, elliptic, or oblong-oblong, 13–22 × 5–11 cm, adaxially glabrous, abaxially scabrous, base acute to attenuate, margin sometimes weakly sinuate, apex acuminate or mucronulate; secondary veins 10–14 pairs; stipules interpetiolar, triangular, ovate, or ovate-lanceolate, acute, acuminate, or bifid. Inflorescence leaf-opposed; peduncle 1 (or 2), 1–2 cm, glabrous; heads 1 per peduncle, globose, many flowered; bracteoles 3–5, subulate. Flowers fused at base, biology not noted. Calyx limb truncate. Corolla pink, salverform, outside glabrous; tube ca. 22 mm, somewhat curved, glabrous inside; lobes 4 or 5, lanceolate, ca. 4 mm. Young drupelet globose, ca. 1 cm in diam. Young drupes dark red. Fl. summer, fr. autumn.

• Sparse forests on hill slopes; 500–800 m. S Yunnan.

The protologue gave the number of corolla lobes as 5, but the protologue figure shows 4 corolla lobes.

**22. *Morinda rugulosa*** Y. Z. Ruan, Fl. Reipubl. Popularis Sin. 71(2): 328. 1999.

皱面鸡眼藤 zhou mian ji yan teng

Lianas or subshrubs, to 6 m tall; branches when young pilosulous, becoming glabrescent. Leaves opposite; petiole 6–9 mm, hirtellous; blade drying papery, adaxially brownish black, abaxially ferruginous, obovate or obovate-lanceolate, 7–9 × 2.5–4 cm, adaxially rugulose and sparsely pilosulous to glabrescent, abaxially glabrous except hirtellous along midrib, base cuneate or attenuate, apex rounded, obtuse, or acute; secondary veins 5 or 6 pairs, with pilosulous domatia; stipules fused into a tube, 3–4 mm, truncate. Inflorescence terminal; peduncles 4–8, umbellate, 7–15 mm, pilosulous; heads 1 per peduncle, 5–12-flowered. Flowers fused in lower half of hypanthium, biology not noted. Calyx limb reduced. Corolla white, campanulate; tube ca. 1 mm, inside densely bearded; lobes 4, narrowly oblong, ca. 3 mm, apically rostrate. Drupecetum subglobose, 4–10 mm in diam. Drupes fully fused, red. Fl. Jul, fr. Dec.

• Forests at riversides and roadsides, thickets. N Guangxi, SW Hunan.

**23. *Morinda scabrifolia*** Y. Z. Ruan, Fl. Reipubl. Popularis Sin. 71(2): 332. 1999.

西南巴戟 xi nan ba ji

Lianas or shrubs; branches when young densely hirtellous, becoming glabrescent, angled, whitened, pale purplish blue, or brown. Leaves opposite; petiole 5–15 mm, hirtellous; blade drying papery or leathery, adaxially brownish yellow or brownish gray, abaxially pale brown, elliptic-oblong, oblong-lanceolate, or oblong-linear, 7–13 × 2–4 cm, adaxially sparsely hirtellous, subglabrous, or glabrous, abaxially glabrous or strigillose-pilosulous at least on principal veins, base cuneate or rounded, apex acute, acuminate, or obtuse then abruptly mucronulate; secondary veins 5–7 pairs; stipules 3–5 mm. Inflorescence terminal; peduncles 3–10, fasciculate or umbellate, 5–20 mm, puberulent, as a group sometimes subtended by 1 linear bract; heads 1 per peduncle, 5–10-flowered. Flowers fused at base, biology not noted. Calyx limb reduced, truncate. Corolla white, urceolate to campanulate, outside puberulent; tube ca. 2.5 mm, inside densely bearded; lobes 4 or 5, linear, ca. 2.5 mm. Drupecetum subglobose, ca. 1 cm in diam. Fl. Jun, fr. Sep–Oct.

• Forests or thickets on mountains, shady rock sides. Guangxi, Jiangxi, Sichuan, Yunnan.

**24. *Morinda shuanghuaensis*** C. Y. Chen & M. S. Huang, J. Trop. Subtrop. Bot. 16: 578. 2008.

假巴戟 jia ba ji

Lianas; branches when young hirtellous, becoming glabrescent, angled, bluish black. Leaves opposite; petiole 3–5 mm, hirtellous; blade drying papery or thinly papery and brown, elliptic, elliptic-oblong, or obovate-oblong, 4–10(–13) × 2.5–5 cm, adaxially hirsute to pubescent or sparsely hispidulous, abaxially glabrous or sparsely pilosulous along midrib, base rounded or cuneate, apex acute or mucronulate; secondary veins 5 or 6 pairs; stipules 3–5 mm, pilosulous, truncate. Inflores-

cence terminal; peduncles 4–8, umbellate, 3–15 mm, pubescent; heads 1 per peduncle, 3–8-flowered. Flowers fused at base, biology not noted. Calyx limb reduced, truncate or with 2 or 3 undulate teeth. Corolla white, urceolate, outside puberulent; tube ca. 3 mm, inside densely bearded; lobes 3 or 4, narrowly oblong, ca. 3 mm, apically thickened and rostrate. Drupecetum compressed globose. Drupes red. Fl. May–Jul, fr. Oct.

- Forests on mountains. Fujian, Guangdong.

Y. Z. Ruan (in FRPS 71(2): 201. 1999) described the roots as irregularly intestine-like constricted, with cortex more or less fleshy.

**25. *Morinda umbellata*** Linnaeus, Sp. Pl. 1: 176. 1753.

印度羊角藤 yin du yang jiao teng

Lianas, climbing or twining; branches glabrous to puberulent or hispidulous, becoming weakly angled, often channeled, bluish black to reddish brown. Leaves opposite; petiole 4–6 mm, glabrous, puberulent, or sparsely hirsute; blade drying papery, leathery, or rigid-membranous, adaxially shiny and greenish, pale brown, or brownish black, abaxially matte, greenish, pale brown, or straw-colored, ovate, obovate-lanceolate, obovate-oblong, lanceolate, or linear-lanceolate, 6–9 × 2–3.5 cm, both surfaces glabrous or sometimes hirsute, hispidulous, or puberulent along principal veins, base acute or cuneate, apex acuminate or mucronulate; secondary veins 4 or 5 pairs, usually with pilosulous domatia; stipules fused into a tube, 2–6 mm, scarious to membranous, puberulent, broadly rounded to truncate, on each side with 2 bristles 0.5–1 mm, often caducous. Inflorescence terminal; peduncles 3–11, fasciculate, umbellate, or shortly racemiform, 4–11 mm, puberulent to glabrescent, subtended by 1 to several linear caducous bracts 1–2 mm; heads 1 per peduncle, subglobose to obovate, 1–10 mm in diam., 6–12-flowered. Flowers fused at base or for up to half of hypanthium, biology not noted. Calyx glabrous; limb 0.2–0.8 mm, truncate to denticulate. Corolla white, campanulate, outside glabrous to puberulent; tube 1.2–2 mm, inside densely villous from middle to throat; lobes 4 or 5, narrowly oblong to ligulate, 2.2–3 mm, apically thickened and hooked. Drupecetum subglobose or compressed globose, 7–12 mm in diam., glabrescent. Drupes mostly to fully fused, red, subglobose, 4–5 mm. Fl. Jun–Jul, fr. Oct–Nov.

Forests on mountains, sparse or dense thickets at streamsides and roadsides; 300–1200 m. Anhui, Fujian, Guangdong, Guangxi, Hainan, Hunan, Jiangsu, Jiangxi, Taiwan, Zhejiang [India, Japan, Sri Lanka, S Thailand].

This is the most commonly collected species of *Morinda* in China. This species is here circumscribed broadly and a bit differently from FRPS (71(2): 190–191. 1999); in particular, the species is restricted to glabrous plants there but pubescent plants are included here. There seems to be no other difference among these two sets of plants, and on specimens there is continuous variation in pubescence that cannot be clearly partitioned into separate states.

- 1a. Leaf blade drying papery or leathery, ovate, obovate-lanceolate, or obovate-oblong; petioles puberulent to sparsely hirsute ..... 25a. subsp. *obovata*

- 1b. Leaf blade rigid-membranous, lanceolate to linear-lanceolate; petioles glabrous ..... 25b. subsp. *umbellata*

**25a. *Morinda umbellata*** subsp. *obovata* Y. Z. Ruan, Fl. Reipubl. Popularis Sin. 71(2): 325. 1999.

羊角藤 yang jiao teng

Petiole puberulent to sparsely hirsute; leaf blade drying papery or leathery, ovate, obovate-lanceolate, or obovate-oblong. Fl. Jun–Jul, fr. Oct–Nov.

- Forests on mountains, sparse or dense thickets at streamsides and roadsides; 300–1200 m. Anhui, Fujian, Guangdong, Guangxi, Hainan, Hunan, Jiangsu, Jiangxi, Taiwan, Zhejiang.

**25b. *Morinda umbellata*** subsp. *umbellata*

印度羊角藤(原亚种) yin du yang jiao teng (yuan ya zhong)

Petiole glabrous; leaf blade drying rigid-membranous, lanceolate to linear-lanceolate. Fl. Jun–Jul, fr. Oct–Nov.

Forests on mountains, sparse or dense thickets at streamsides and roadsides; 300–1200 m. Anhui, Fujian, Guangdong, Guangxi, Hainan, Hunan, Jiangsu, Jiangxi, Taiwan, Zhejiang [India, Japan, Sri Lanka].

**26. *Morinda undulata*** Y. Z. Ruan, Fl. Reipubl. Popularis Sin. 71(2): 321. 1999.

波叶木巴戟 bo ye mu ba ji

Small trees, to 20 m tall; branches glabrous, subquadrangular, smooth, reddish brown. Leaves opposite or solitary opposite an inflorescence; petiole 1–2 cm, glabrous; blade drying yellowish brown, linear-oblong, linear-oblong-lanceolate, or slightly lyrate, 18–20 × 4–5.5 cm, glabrous and shiny on both surfaces, base cuneate, margin irregularly undulate to lyrate, apex acute or acuminate; secondary veins 12–24 pairs; stipules interpetiolar, triangular to broadly triangular, acute to obtuse. Inflorescence solitary and leaf-opposed; peduncle 1, 1–6 cm, glabrous; heads 1 per peduncle, ellipsoid-oblong to cylindrical, many flowered; bracts absent or subulate. Flowers with hypanthia fully fused, biology not noted. Calyx limb truncate. Corolla white, salverform; tube 15–18 mm, densely villous in upper part and throat; lobes 4 or 5, triangular to ligulate, 3–4 mm, acute. Drupecetum mulberry-shaped to cylindrical or oblong, 1–1.5 × 0.6–0.8 cm. Fl. autumn, fr. winter.

- About 900 m. S Yunnan (also cultivated in villages).

The protologue described the corolla lobes as 4, but the protologue figure shows 5 lobes.

**27. *Morinda villosa*** J. D. Hooker, Fl. Brit. India 3: 158. 1880.

须弥巴戟 xu mi ba ji

Woody lianas; branches surrounded at base by persistent leafless stipules, densely ferruginous- or yellow villous, weakly quadrangular. Leaves opposite; petiole 0.5–1.5 cm, shorter at upper nodes, densely ferruginous- or yellow hirtellous; blade drying papery, darkened, narrowly elliptic-oblong, obovate-lanceolate, or lanceolate, 8–12 × 2–6 cm, adaxially sparsely stri-

gose or strigillose with pubescence denser along veins, abaxially densely ferruginous- or yellow hirtellous, base rounded, slightly oblique, or sometimes cordulate, apex caudate-acuminate or shortly acuminate; secondary veins 10–13 pairs, with pilosulous domatia; stipules interpetiolar or partially fused into a tube, ovate to elliptic, 7–12 mm, pilosulous or hirtellous, acute, obtuse, or truncate. Inflorescences terminal; peduncles 2–10, fasciculate or umbellate, 0.9–2.2 cm, villosulous, as a group subtended by 2 to several bracts 4–6 mm with 2 to several subulate lobes; heads 1 per peduncle, subglobose, 5–6 mm in

diam., 4–10-flowered; bracteoles linear, 0.2–0.5 mm. Flowers with hypanthia partially fused, biology not noted. Calyx villous, strigillose, or hirtellous; limb ca. 1 mm, with 4 or 5 rounded to obtuse teeth. Corolla greenish white, salverform, outside puberulent; tube 10–12 mm, densely barbate in throat; lobes 4 or 5, narrowly oblong, 3–4 mm, apically rostrate. Drupecetum compressed globose to subglobose, 1–1.5 cm in diam. Drupes fused at base, orange, obovoid, ca. 5 mm. Fl. May, fr. Jul–Sep.

Forests or thickets in valleys, at watersides, or at roadsides; 800–900 m. S Yunnan [N India, Thailand, Vietnam].

## 55. MOURETIA Pitard in Lecomte, Fl. Indo-Chine 3: 71. 1922.

杜丽草属 du li cao shu

Chen Tao (陈涛); Charlotte M. Taylor

Perennial herbs or subshrubs, unarmed; stems sometimes becoming corky. Raphides present. Leaves opposite, sometimes anisophyllous, apparently without domatia; stipules persistent, interpetiolar, triangular to leaflike, often reflexed, acute to bifid. Inflorescences terminal, pseudoaxillary [or sometimes axillary, *Mouretia vietnamensis* Tange], capitate, subcapitate, or congested-cymose, several to many flowered, subsessile to pedunculate, bracteate. Flowers sessile to pedicellate, bisexual, distylous, sometimes fused by their ovaries. Calyx limb 5-lobed. Corolla white, yellow, or pink, tubular-funnelform to salverform, inside densely pubescent at middle and sometimes through throat; lobes 5, valvate in bud. Stamens 5, inserted near middle of corolla tube, included with anthers positioned near middle of corolla tube in long-styled form, exerted in short-styled form; filaments short or reduced in long-styled form, well developed in short-styled form; anthers dorsifixed near base. Ovary 2-celled, ovules numerous in each cell on axile placenta; disk puberulent; stigma 2-lobed, exerted in long-styled form, included in short-styled form. Fruit capsular, obconic to subglobose, dehiscent through apical portion or operculum inside persistent calyx limb, thinly to thickly papery; seeds numerous, small, angled.

Five species: E and SE Asia; one species in China.

This genus was revised by Tange (Nordic J. Bot. 17: 123–132. 1997), who recognized four species from Indochina but documented each with few specimens. *Mouretia* was studied in China by H. S. Lo (Bull. Bot. Res., Harbin 6(4): 48. 1986; Bull. Bot. Res., Harbin 18(3): 282. 1998), who apparently did not have communication with Tange: they independently described and named the same Chinese species, which are here synonymized (Tange's publication has priority). The known species of *Mouretia* are distylous (Tange, loc. cit.; Puff et al., Rubiaceae of Thailand, 182. 2005). The breeding biology of the Chinese plants has not been reported by Chinese authors and is not evident from the material available to us but is presumably similar. Lo (in FRPS 71(1): 183. 1999) described the stipules as caducous, but they are persistent on the specimens seen and according to Tange.

**1. *Mouretia inaequalis*** (H. S. Lo) Tange, Nordic J. Bot. 17: 127. 1997.

广东杜丽草 guang dong du li cao

*Mouretia tonkinensis* Pitard var. *inaequalis* H. S. Lo, Bull. Bot. Res., Harbin 6(4): 48. 1986; *M. guangdongensis* H. S. Lo.

Weak herbs, 30–40 cm tall; stems angled to subterete, densely puberulent or villosulous-tomentulose to glabrescent. Leaves subequal to distinctly unequal, varied along stems; petiole 5–15 mm, densely villosulous; blade drying thinly papery and olive-green, elliptic-oblong, elliptic, elliptic-ovate, or obovate, larger blades 4–9 × 2–4 cm, smallest blades 1.5–2 × 0.8–1 cm, adaxially glabrous, abaxially glabrescent on lamina and villosulous to strigillose-villosulous along principal veins, base cuneate, obtuse, or rounded, apex acute to obtuse and shortly acuminate; secondary veins 5–8 pairs; stipules leaflike, shortly stipitate with “blade portion” subovate to obovate or subreniform, (1–)2.5–5 mm, glabrescent, obtuse to rounded. Inflorescences congested-cymose, terminal and/or pseudoaxillary, several flowered, densely puberulent-tomentulose to strigillose;

peduncle 2–5 mm; bracts lanceolate to narrowly triangular, 1–2 mm; pedicels to 1.5 mm. Flowers free, subsessile to pedicellate. Calyx puberulent-hispidulous; hypanthium portion obovoid, 1–1.5 mm; limb lobed nearly to base; lobes lanceolate to narrowly triangular, 1.7–2(–2.5) mm, entire to ciliolate. Corolla yellow, white, or pink, tubular-salverform, densely hispidulous-puberulent with stout trichomes outside; tube 2–2.5 mm, internally with ring of trichomes near middle; lobes triangular, ca. 2 mm, abaxially appendaged near apex. Capsules obconical-subglobose, ca. 3 mm, glabrescent to puberulent, with persistent calyx limbs sometimes elongating to 3 mm; seeds 0.4–0.5 mm. Fl. Aug, fr. May.

On rocks in dense forests. Fujian, Guangdong, Guangxi (Qinzhou) [Vietnam].

The description above includes measurements from Tange based on specimens from Vietnam, including near the Chinese border. This species is illustrated by Tange (loc. cit.: 126, t. 2, f. D). Tange separated *Mouretia tonkinensis* from the Chinese plants by its consistently isophyllous leaves, fully capitate inflorescences, calyx lobes with tips quickly becoming scarious and whitened, smaller corollas (with tube ca. 2.5 and lobes 1.1 mm), and smaller fruit (ca. 1.5 mm).

**56. MUSSAENDA** Linnaeus, Sp. Pl. 1: 177. 1753.玉叶金花属 *yu ye jin hua shu*

Chen Tao (陈涛); Charlotte M. Taylor

*Belilla* Adanson.

Trees, shrubs, or clambering or twining lianas, rarely dioecious, unarmed. Raphides absent. Leaves opposite or occasionally in whorls of 3, with or usually without domatia; stipules persistent or caducous, interpetiolar, entire or 2-lobed. Inflorescences terminal and sometimes also in axils of uppermost leaves, cymose, paniculate, or thyriform, several to many flowered, sessile to pedunculate, bracteate. Flowers sessile to pedicellate, bisexual and usually distylous or rarely unisexual. Calyx limb 5-lobed nearly to base, frequently some or all flowers of an inflorescence with 1(–5) white to colored, petaloid, persistent or deciduous, membranous, stipitate calycophyll(s) with 3–7 longitudinal veins. Corolla yellow, red, orange, white, or rarely blue (*Mussaenda multinervis*), salverform with tube usually slender then abruptly inflated around anthers, or rarely constricted at throat (*M. hirsuta*), inside variously pubescent but usually densely yellow clavate villous in throat; lobes 5, valvate-reduplicate in bud, often long acuminate. Stamens 5, inserted in middle to upper part of corolla tube, included; filaments short or reduced; anthers basifixed. Ovary 2-celled, ovules numerous in each cell, inserted on oblong, fleshy, peltate, axile placentas; stigmas 2-lobed, lobes linear, included or exerted. Fruit purple to black, baccate or perhaps rarely capsular (*M. decipiens*), fleshy, globose to ellipsoid, often conspicuously lenticellate, with calyx limb persistent or caducous often leaving a conspicuous scar; seeds numerous, small, angled to flattened; testa foveolate-striate; endosperm abundant, fleshy.

About 200 species: widespread in tropical Africa, Asia, Madagascar, and Pacific islands; 29 species (18 endemic, one introduced) in China.

The characteristic large, petaloid calycophylls of *Mussaenda* are frequently but mistakenly considered to be bracts. *Mussaenda* is frequently confused with *Schizomussaenda*; *Schizomussaenda* can be recognized by its large shrub habit with relatively large leaves and calycophylls, its capsular fruit, and its flower buds with the corollas clavate and rather flat-topped with the acuminate ends of the corolla lobes then bent upward to form an erect appressed group of filaments on the top of the bud.

Several species of *Mussaenda* are frequently cultivated as ornamentals in tropical regions. *Mussaenda philippica* A. Richard is apparently the most commonly cultivated species and has numerous cultivar forms; Puff et al. (Rubiaceae of Thailand, 215. 2005) presented photos of several of the cultivated forms. This species is pilosulous to villous throughout, with white to pink flowers and calycophylls and with calyx lobes variously 1 to all modified into calycophylls. Also frequently cultivated are *M. frondosa* of our flora and *M. erythrophylla* Schumacher & Thonning of Africa; the latter has pilose to villous pubescence on all organs, including the corollas, and deep red inflorescence axes and flowers, including the calycophylls and the outside of the corolla but excepting the corolla limb, which is creamy white.

In addition to the species treated here, Hooker and Arnott (Bot. Beechey Voy. 265. 1838) reported *Mussaenda glabra* Vahl from “Loo Choo” in China. *Mussaenda glabra* was described from the Himalaya and has medium-sized leaves, a climbing habit, petioles 3–15 mm, a corymbiform branched inflorescence, calyx lobes 1–4 mm and deciduous in fruit, corolla tubes 13–18 mm, and corolla lobes 3–3.5 mm; this species is otherwise known from 300–1300 m in India and Bhutan and has not been confidently recorded from China. The name “*M. glabra*” has been frequently applied in herb. to Chinese specimens of both *M. erosa* and *M. frondosa*. Also Henry 8279 from Hainan was treated by C. E. C. Fisher (Bull. Misc. Inform. Kew 1928: 274. 1928) as *M. parryorum* C. E. C. Fisher, a species otherwise known only from Assam, NE India. This identification seems unlikely, especially given that *M. parryorum* has not otherwise been reported or treated from China or Indochina, so the Henry specimen will need re-examination. *Mussaenda parryorum* is included for reference in the key below, based on its protologue, but the species is not otherwise treated here.

H. H. Hsue and H. Wu (in FRPS 71(1): 283–306. 1999), Hutchinson (in Sargent, Pl. Wilson. 3: 395–400. 1916), and some other authors have distinguished *Mussaenda* species in large part based on leaf shape, ovary length, calyx lobe length, and corolla size, but the consistency and distinctiveness of these characters within species of *Mussaenda* have been questioned by some other authors. In particular, corolla size is apparently sometimes widely variable among living plants in a population (see comments by Wood, Fl. Bhutan 2(2): 781. 1999), and the flower buds of *Mussaenda* apparently often open prematurely when collected and thus are shorter than flowers at anthesis (pers. obs.). The calyx lobes and the ovary often elongate after fertilization of the ovary, and the calyx lobes then fall off; thus, fruiting plants are very difficult to identify. Also Hutchinson misidentified several widely distributed sets of Chinese *Mussaenda* specimens, generating confusion in this group (e.g., he identified Henry 12157 as *M. pubescens* in spite of its pedicellate flowers with corolla tubes ca. 32 mm, vs. sessile and 11–20 mm in *M. pubescens*); and he described only the “typical” leaf size and shape of several species although he saw material with more variability. The weakness in some cases of Hutchinson’s characters and species concepts is shown by his simultaneous description in his *Mussaenda* treatment of two new species that were separated primarily on vegetative features and actually are both based on different specimens of a single distinctive species, *Schizomussaenda dehiscens*.

As noted below, *Mussaenda multinervis* and *M. decipiens* were both described as having capsular fruit and most likely belong in other genera, but which other genus or genera is not yet clear so they are maintained here. The measurements below of inflorescence size do not include the corollas and calycophylls.

1a. Individual flowers with all 5 calyx lobes enlarged into petaloid calycophylls.

2a. Petiole 0.3–0.8 cm, leaf blade 2–9 × 1–4 cm; calyx lobes linear ..... 25. *M. pubescens*

2b. Petiole 1.5–3.5 cm, leaf blade 6–20 × 3.5–13 cm; calyx lobes lanceolate to ovate, 2–2.5 mm wide ..... 27. *M. shikokiana*

1b. Individual flowers with only 1 or 2 calyx lobes enlarged into a petaloid calycophyll, or without calycophylls.

3a. Calyx lobes (i.e., not calycophylls) subleaflike, 1.5–5 mm wide, lanceolate, oblanceolate, oblong-lanceolate, ligulate, or broadly triangular.

- 4a. Corolla tube 20–25 mm, sericeous with appressed indument, sericeous with apices of trichomes spreading, or villous.
- 5a. Stems sericeous with appressed indument; stipules 5–8 × 4–5 mm; calyx lobes 4–11 mm ..... 19. *M. macrophylla*
- 5b. Stems villous or hirsute with widely spreading trichomes; stipules 7–10 × 6–12 mm; calyx lobes 7–18 mm ..... 29. *M. treutleri*
- 4b. Corolla tube 9–14 mm, sericeous.
- 6a. Stipules triangular-ovate to broadly ovate, acute to cuspidate; corolla tube 10–11 mm; berries ellipsoid ..... 9. *M. emeiensis*
- 6b. Stipules triangular to ovate-lanceolate, acute; corolla tube 9–14 mm; berries ellipsoid to subglobose ..... 27. *M. shikokiana*
- 3b. Calyx lobes less than 1.5 mm wide, linear to narrowly triangular, not at all leaflike.
- 7a. Stipules 13–20 mm, lobed for less than half their length; corolla yellow or pale blue.
- 8a. Corolla pale blue; leaves 8.5–12 cm wide; calyx lobes ca. 2 mm; fruit baccate ..... 22. *M. multinervis*
- 8b. Corolla yellow; leaves 2.5–7.5 cm wide; calyx lobes 1–4 mm; fruit capsular.
- 9a. Calyx lobes 3–4 mm; leaves 6–7.5 cm wide ..... 5. *M. decipiens*
- 9b. Calyx lobes 1–2 mm; leaves 2.5–6 cm wide ..... *Schizomussaenda dehiscens*
- 7b. Stipules 2–8 mm, deeply 2-parted; corolla white, yellow, or orange.
- 10a. Leaves sessile, subsessile, or shortly petiolate with petioles to 3 mm, obtuse, rounded, truncate, or cordulate and then sometimes decurrent at base, if petioles more than 2 mm then leaves truncate or cordulate.
- 11a. Leaf blade obtuse to rounded then abruptly acuminate at apex; corolla tube outside densely villous with pubescence drying reddened; stems densely villous ..... 26. *M. sessilifolia*
- 11b. Leaf blade tapered to acuminate apex; corolla tube outside with sparse to dense villosulous, pilosulous, tomentulose, strigose, or strigillose pubescence drying clear, whitened, or reddened; stems strigillose, villous, villosulous, or tomentulose.
- 12a. Corolla tube 20–26 mm; inflorescences shortly branched, flowers with pedicels ca. 1 mm ..... 14. *M. hossei*
- 12b. Corolla tube 11–20 mm; inflorescences subcapitate to congested, flowers mostly or all sessile to subsessile.
- 13a. Calyx lobes ca. 2 mm ..... 2. *M. breviloba*
- 13b. Calyx lobes 3–6 mm ..... 25. *M. pubescens*
- 10b. Leaves distinctly petiolate with petioles 2–15 mm, truncate, obtuse, acute, or attenuate at base, if petioles 3 mm or shorter then leaves acute.
- 14a. Leaves glabrous throughout or sparsely strigose on principal veins, drying thickly papery and usually brown, with tertiary venation sparsely visible abaxially, widely spaced and subparallel, not areolate; stipules caducous exposing a persistent, reddish brown fringe of trichomes ..... 10. *M. erosa*
- 14b. Leaves glabrous or pubescent at least sparsely on veins abaxially, drying thinly to thickly papery or membranous and green to brown, with tertiary venation regularly visible abaxially, subparallel or areolate; stipules persistent or deciduous, without persistent fringe of trichomes or this present and clear or whitened.
- 15a. Corolla tube constricted at throat ..... 13. *M. hirsutula*
- 15b. Corolla tube uniformly cylindrical or inflated just below or at throat.
- 16a. Calyx lobes 25–30 mm, as long as or longer than corolla tube ..... 15. *M. kwangsiensis*
- 16b. Calyx lobes 1–15 mm, shorter than corolla tube.
- 17a. Corolla tube 5–8 mm; fruit stipitate or pedicellate, pedicels to 12 mm ..... 23. *M. parviflora*
- 17b. Corolla tube 5–40 mm; fruit sessile or subsessile to pedicellate, pedicels to 8 mm.
- 18a. Flowers sessile in 1–5 capitate groups; bracts and calyx lobes linear, 8–15 mm, and so densely hirsute as to obscure inflorescence morphology ..... 6. *M. densiflora*
- 18b. Flowers sessile to pedicellate in cymes with axes at least shortly developed; bracts and calyx lobes narrowly triangular to lanceolate, 1–15 mm, glabrous to variously pubescent, inflorescence morphology obscured or evident.
- 19a. Longest calyx lobes 6–15 mm on flowers at anthesis, longer than hypanthium portion.
- 20a. Corolla lobes 6–8 mm.
- 21a. Cultivated plants; leaves strigose, strigillose, or glabrescent abaxially ..... 11. *M. frondosa*
- 21b. Native plants; leaves hirsute, subappressed villous, pilose, or strigose abaxially.
- 22a. Calyx densely villous, with pubescence spreading ..... 3. *M. caudatiloba*
- 22b. Calyx hirsute ..... 6. *M. densiflora*
- 20b. Corolla lobes 2.5–6 mm, at least some shorter than 6 mm.
- 23a. Corolla tubes 26–30 mm.
- 24a. Inflorescences densely congested; flowers sessile or subsessile ..... 13. *M. hirsutula*
- 24b. Inflorescences congested to laxly cymose; flowers with pedicels 1–5 mm ..... 17. *M. laxiflora*
- 23b. Corolla tubes 11–25 mm.

- 25a. Fruit ellipsoid to ellipsoid-oblong, 18–20 × 11–12 mm, densely lenticellate, somewhat woody; stems and leaves abaxially densely villosulous to tomentulose; Hainan ..... 12. *M. hainanensis*
- 25b. Fruit subglobose to ellipsoid, 5–10 × 4–10 mm, smooth, fleshy or stiffly papery; stems and leaves abaxially glabrescent to variously pubescent; widespread.
- 26a. Corolla with tube ca. 14 mm, lobes ca. 2.5 mm; Yunnan, elevation not noted ... 24. *M. pingbianensis*
- 26b. Corolla with tube 11–23 mm, lobes 2.5–5 mm; widespread, below 100–1600 m.
- 27a. Leaves 2–11.5 × 1–4.5 cm; flowers sessile to pedicellate, white to yellow; below 100–900 m, throughout China ..... 25. *M. pubescens*
- 27b. Leaves 6–20 × 3–10 cm; flowers sessile, mixed sessile and pedicellate, or all pedicellate with pedicels to 3 mm, yellow-orange; S China, 300–1400 m.
- 28a. Corolla lobes rounded ..... 28. *M. simpliciloba*
- 28b. Corolla lobes acute or acuminate.
- 29a. Climbers; leaves 8–13 × 3–6 cm ..... 6. *M. densiflora*
- 29b. Erect shrubs; leaves 6–20 × 3–10 cm ..... 8. *M. elliptica*
- 19b. Longest calyx lobes 1–5.9 mm, shorter than to longer than hypanthium portion.
- 30a. Corolla tube ca. 40 mm ..... 16. *M. kwangtungensis*
- 30b. Corolla tube 5–37 mm.
- 31a. Stems densely tomentose.
- 32a. Erect shrubs; calyx lobes 3–4 mm; corolla lobes acuminate ..... 21. *M. mollissima*
- 32b. Climbers; calyx lobes 5–7 mm; corolla lobes rounded ..... 28. *M. simpliciloba*
- 31b. Stems appressed pubescent to glabrescent.
- 33a. Most or all calyx lobes 1–2 mm.
- 34a. Leaves with 4–6 pairs of lateral veins; Hainan.
- 35a. Corolla tube 25–31 mm; calycophylls elliptic to ovate ..... 1. *M. antiloga*
- 35b. Corolla tube 13–15 mm; calycophylls oblong-elliptic or oblanceolate ..... 18. *M. lotungensis*
- 34b. Leaves with 6–8 pairs of lateral veins; mainland.
- 36a. Corolla tube ca. 12.8 mm ..... 2. *M. breviloba*
- 36b. Corolla tube 18–21 mm.
- 37a. Leaves 5.5–7.5 × 3–4.7 cm; petioles 0.5–0.6 cm ..... 4. *M. chingii*
- 37b. Leaves 10–17 × 2.5–6 cm; petioles 0.5–1.6 cm ..... *Schizomussaenda dehiscentis*
- 33b. Most or all calyx lobes 2.3–5.9 mm.
- 38a. Corolla with tube ca. 32 mm and lobes ca. 4 mm; Hainan ..... 20. *M. membranifolia*
- 38b. Corolla with tube 11–25 mm and lobes 2–6 mm; widespread, including Hainan.
- 39a. Corolla lobes ca. 2 mm.
- 40a. Corolla tube ca. 22 mm; Assam (not known from China, included here for reference) ..... *M. parryorum* (see comment above)
- 40b. Corolla tube 13–15 mm; Hainan ..... 18. *M. lotungensis*
- 39b. Corolla lobes 3.5–6 mm; widespread.
- 41a. Inflorescences subcapitate, mostly unbranched; flowers 3–20, sessile to subsessile (though fruit may be stipitate).
- 42a. Corolla tube 22–25 mm; stems generally without axillary short shoots ..... 6. *M. densiflora*
- 42b. Corolla tube 11–20 mm; stems often with axillary short shoots with small leaves ..... 25. *M. pubescens*
- 41b. Inflorescences branched, at least to one order, i.e., tripartite; flowers 5 to numerous, sessile to long pedicellate.
- 43a. Stems strigose; near sea level to 1400 m ..... 7. *M. divaricata*
- 43b. Plants tomentose to glabrescent; 1200–1400 m ..... 28. *M. simpliciloba*

**1. *Mussaenda antiloga*** Y. H. Chun & W. C. Ko, Fl. Hainan. 3: 582. 1974.

壮丽玉叶金花 *zhuang li yu ye jin hua*

Climbing shrubs; branches terete, sparsely strigillose to glabrescent. Leaves opposite; petiole 3–10 mm, densely strigillose to glabrescent; blade drying membranous, elliptic-oblong, elliptic, or oblanceolate, 7–11(–18) × 2–5.5 cm, adaxially sparsely strigillose to glabrescent, abaxially moderately to

sparsely strigillose with pubescence denser on veins, base acute to obtuse, apex acuminate; secondary veins 4–6 pairs, tertiary venation visible and reticulate; stipules deciduous, triangular to ovate, 3–6 mm, densely strigillose, deeply 2-lobed, lobes narrowly triangular to linear. Inflorescence laxly cymose, usually regularly dichotomous, ca. 5 × 4–5 cm, strigillose to glabrescent, pedunculate; peduncles 3.5–4 cm; bracts subulate, 1–3 mm; pedicels 1–5 mm. Flowers pedicellate (or on higher order inflorescence axes). Calyx with hypanthium portion ellipsoid to

turbinate, 2–3 mm, glabrous; lobes narrowly triangular to linear, 1–2 mm, strigillose, 1 lobe on 1 flower of most inflorescences enlarged into calycophyll, blade elliptic or ovate, 3–5 × 2–3 cm, sparsely puberulent to strigillose especially on veins, base obtuse, stipe 15–24 mm, apex acute to obtuse. Corolla yellow, outside sparsely to moderately strigillose; tube 22–31 mm, inside with clavate hairs at inflated throat; lobes broadly ovate, 3–4 mm, inside densely yellow papillose. Berry subglobose or ellipsoid, 8–10 × 5–7 mm, glabrous, with calyx limb caducous. Fl. May–Dec.

- Wet sites in dense forests; ca. 900 m. S Hainan.

H. H. Hsue and H. Wu (in FRPS 71(1): 296. 1999) gave the corolla tube length of this species as 22–25 mm, but the corolla tube of the type specimen is ca. 31 mm; this report is added here.

**2. *Mussaenda breviloba*** S. Moore, J. Bot. 43: 137. 1905.

短裂玉叶金花 *duan lie yu ye jin hua*

Shrubs to 1.5 m tall; branches terete, ferruginous tomentose. Leaves opposite; petiole 1–5 mm, tomentulose; blade drying stiffly papery, long elliptic to broadly elliptic, 5.5–10 × 3.5–5 cm, adaxially sparsely strigillose with pubescence denser along veins, abaxially pale tomentose along veins with indument grayish white and brownish, base obtuse, apex acuminate or acute; secondary veins 7 or 8 pairs; stipules triangular-ovate, 4–5 mm, deeply 2-lobed, lobes triangular-subulate. Inflorescence cymose to corymbiform, densely flowered to rather lax, ca. 4.5 × 7–8 cm, brown tomentose, pedunculate; bracts subulate, 3–5 mm, acute; pedicels 1–2 mm. Flowers sessile or pedicellate. Calyx tomentose; hypanthium portion ellipsoid to turbinate, 1.5–2.5 mm; lobes lanceolate or triangular-linear, ca. 2 mm, sometimes 1 lobe on 1 flower per inflorescence expanded into calycophyll, blade elliptic, 3–4 × 1–2 cm, both surfaces pubescent with pubescence denser along veins, base acute, stipe ca. 6 mm, apex acute or obtuse. Corolla pale yellow, externally densely tomentulose to strigose; tube ca. 12.8 mm, with clavate hairs in throat; lobes triangular, ca. 2.2 mm, acuminate. Berry unknown. Fl. Apr.

Roadsides in mountain forests; ca. 1300 m. Yunnan [Thailand].

This species was described from Thailand, and characters from there are added to the description here. H. H. Hsue and H. Wu (in FRPS 71(1): 291. 1999) described the corolla tubes as 20–23 mm, which would make this species very similar to *Mussaenda laxiflora*, but the protologue described them as ca. 12.8 mm.

**3. *Mussaenda caudatiloba*** D. Fang, Acta Phytotax. Sin. 40: 156. 2002.

尾裂玉叶金花 *wei lie yu ye jin hua*

Shrubs, erect to climbing, size not reported; branches terete, retrorsely to spreading villous. Leaves opposite; petiole 5–10 mm, villous; blade drying thinly papery, dark green adaxially, pale abaxially, ovate to lanceolate, 4–11 × 2–5 cm, both surfaces subappressed villous with pubescence denser on principal veins, base rounded to rarely cordate, apex acuminate to subcaudate; secondary veins 6–9 pairs; stipules persistent, deeply 2-lobed, villous, lobes linear-subulate, 7–10 mm. Inflorescences congested-cymose, several flowered, densely villous,

pedunculate; peduncle 0.5–1 cm; bracts linear, ca. 8 mm. Flowers sessile. Calyx densely spreading villous; hypanthium portion turbinate, ca. 2.5 mm; lobes linear, 10–13 mm, acute, 1 lobe on 1 or 2 flowers per inflorescence expanded into white calycophyll, blade ovate, 5–6.7 × 3–5.3 cm, appressed villous, base rounded, stipe 18–25 mm, apex acute. Corolla outside spreading grayish villous; tube ca. 25 mm, inside densely clavate puberulent in upper part; lobes triangular-lanceolate, ca. 8 mm, caudate. Berry unknown. Fl. May.

- Thickets. Guangxi.

The pubescence descriptions here are from the protologue.

**4. *Mussaenda chingii*** C. Y. Wu ex H. H. Hsue & H. Wu, Acta Phytotax. Sin. 24: 236. 1986.

仁昌玉叶金花 *ren chang yu ye jin hua*

Shrubs, ca. 1.5 m tall; branches terete, appressed pubescent. Leaves opposite; petiole 5–6 mm, sparsely appressed pubescent; blade drying papery, adaxially shiny green, abaxially glaucous, broadly ovate-elliptic or broadly ovate, 5.5–7.5 × 3–4.7 cm, both surfaces sparsely appressed pubescent with pubescence denser along veins, base rounded or obtuse, apex cuspidate, acute, or acuminate; secondary veins 6 or 7 pairs; stipules deciduous, lanceolate or ovate, ca. 6 mm, densely pubescent, deeply 2-lobed, lobes narrowly triangular. Inflorescences congested-cymose to somewhat lax, ca. 4 × 4.5 cm, densely pubescent, pedunculate or subsessile and tripartite; peduncle 1–1.5 cm; bracts linear, ca. 3.5 mm. Flowers shortly pedicellate. Calyx sparsely to densely pubescent; hypanthium portion cylindrical to ellipsoid, ca. 2.5 mm; lobes lanceolate-triangular, 1.5–2 mm, acuminate, 1 lobe on 1–3 flowers per inflorescence expanded into calycophyll, blade elliptic to obovate, ca. 2.4 cm × 9 mm, pubescent along veins on both surfaces, base cuneate, stipe ca. 10 mm, apex acute. Corolla yellow to orange, outside sparsely to densely appressed pubescent; tube ca. 21 mm, inside densely yellow clavate puberulent in upper part; lobes orbicular-ovate, ca. 2.5 mm, inside yellow papillose, acute to apiculate. Berry unknown. Fl. May.

- Thickets. Guangxi.

**5. *Mussaenda decipiens*** H. Li, Acta Phytotax. Sin. 18: 117. 1980.

墨脱玉叶金花 *mo tuo yu ye jin hua*

Shrubs, 1–2 m tall; branches villous, terete, drying dark green. Leaves opposite; petiole 1–5 cm, densely villous; blade drying papery, elliptic, 13–15 × 6–7.5 cm, adaxially subglabrous, abaxially hirsute with pubescence denser along veins, base narrowly cuneate and decurrent on petiole, apex acuminate; secondary veins 7–9 pairs, tertiary venation indistinct; stipules apparently persistent, linear-lanceolate to lanceolate, 15–20 mm, densely villous, shortly 2-lobed. Inflorescence laxly to rather congested-cymose, generally dichotomous, ca. 10 cm wide, branched 3 or 4 times, villous becoming glabrescent, pedunculate. Flowers subsessile, biology not noted. Calyx with hypanthium portion turbinate, ca. 5 mm, hirtellous; lobes linear, 3–4 mm, sparsely villous, with 1 lobe on ca. 5 flowers per inflorescence expanded into white calycophyll, blade elliptic, ca. 7.5

× 4 cm, base obtuse to cuneate, apex shortly acuminate. Corolla yellow, tubular-salverform, outside densely pale yellow strigose; tube ca. 18 mm; lobes ovate-lanceolate, ca. 6 × 3 mm, abaxially carinate, adaxially densely orange-yellow papillose, long caudate. Capsule or berry globose, ca. 6 mm in diam., smooth, glabrous, with calyx limb persistent. Fl. Aug.

• Broad-leaved forests or thickets on mountain slopes; 300–1700 m. Xizang (Médog), Yunnan (Gongshan).

The protologue described the fruit of this species as capsular, which would be anomalous in *Mussaenda*, although H. H. Hsue and H. Wu (in FRPS 71(1): 293. 1999) described it as a berry.

**6. *Mussaenda densiflora*** H. L. Li, J. Arnold *Arbor.* 24: 455. 1943.

密花玉叶金花 mi hua yu ye jin hua

Climbers, ca. 2 m tall; branches terete, densely yellowish brown villous or hirsute. Leaves opposite; petiole 5–7 mm, densely hirsute; blade drying membranous or thinly papery, broadly oblong-lanceolate or narrowly oblong-elliptic to usually ovate, 8–13 × 3–6 cm, adaxially moderately to sparsely strigose, hirsute, or hirsutulous, abaxially moderately to densely hirsute, pilose, or strigose with pubescence denser on principal veins, base obtuse to rounded and sometimes abruptly attenuate, apex acute or acuminate; secondary veins 8–10 pairs, tertiary venation visible and reticulate; stipules persistent, 8–10 mm, densely villous to hirsute, deeply 2-lobed, lobes lanceolate, narrowly triangular, or linear. Inflorescences capitate or subcapitate with 2–5 subglobose heads, 2–6 × 2–6 cm, densely villous, subsessile to pedunculate; peduncle to 3.5 cm; bracts lanceolate, narrowly triangular, narrowly elliptic, or linear, 10–15 mm. Flowers sessile, biology not noted. Calyx densely hirsute; hypanthium portion urceolate to ellipsoid, 2–3 mm; lobes linear-lanceolate to usually linear, 8–15 × 0.2–2 mm, sometimes 1 lobe of 1 or 2 flowers per inflorescence expanded into white calycophyll, blade ovate, 5–6 × 3–4 cm, moderately to densely strigose to pilose on both surfaces, base obtuse to cordulate, stipe 8–15 mm, apex acute to acuminate. Corolla yellow, outside moderately to densely hirsute; tube 22–25 mm, sometimes contracted around anthers; lobes narrowly lanceolate or orbicular-lanceolate, 6–8 mm, inside densely yellow papillose, long acuminate. Berry ovoid, 8–9 × 6–7 mm, glabrous, with calyx limb deciduous. Fl. May.

Sparse thickets; 300–800 m. Guangxi [Vietnam (*Tsang 29049*, P!)].

This species is said in the protologue to be similar to *Mussaenda subsessilis* Pierre, and it may be that with more specimens the distinctions between them (smaller calycophylls and longer narrower corolla lobes in *M. densiflora*) may turn out to be endpoints of continuous variation. H. H. Hsue and H. Wu (in FRPS 71(1): 300. 1999) described the stipules as caducous, but this has not been seen on specimens studied. The protologue described the corolla tube as 3–3.5 cm, but this does not match specimens seen, including the type; this may have been the length of the entire corolla that was labeled incorrectly in the final article.

**7. *Mussaenda divaricata*** Hutchinson in Sargent, *Pl. Wilson.* 3: 394. 1916.

展枝玉叶金花 zhan zhi yu ye jin hua

Climbing or suberect shrubs; branchlets terete, sparsely or moderately strigose to densely mixed strigose, -strigillose, and -hirtellous, sometimes becoming glabrescent, sometimes with congested groups of leaves borne on reduced axillary buds. Leaves opposite; petiole 0.5–1 cm, densely strigose; blade drying thinly papery, adaxially pale to bright green or brown, abaxially pale gray to bright green, elliptic, lanceolate, elliptic-oblong, or ovate-elliptic, 3.5–12 × 1.5–7 cm, adaxially sparsely strigillose on lamina and densely strigillose on principal veins, abaxially strigillose to glabrous on lamina and densely strigillose along veins, base obtuse to acute, apex acute to abruptly acuminate; secondary veins 5–11 pairs, tertiary venation reticulate to subparallel; stipules usually deciduous, ovate to triangular, 3–7 mm, moderately to densely strigose, deeply 2-lobed, lobes narrowly triangular to subulate. Inflorescence congested to somewhat laxly cymose, 1–2 × 3–4 cm, densely strigose, tripartite and sessile or pedunculate; peduncle 0.3–3.5 cm; bracts narrowly triangular to linear, 1–7 cm, strigose to glabrescent; pedicels to 1.5 mm. Flowers subsessile to pedicellate, biology not noted. Calyx with hypanthium portion ellipsoid to turbinate, 1.5–2 mm, sparsely strigose; lobes subulate, 2.2–5 mm, densely strigillose to strigose, with 1 lobe on 1–3 flowers per inflorescence expanded into white calycophyll, blade broadly elliptic or ovate, 3.5–6 × 3–5 cm, sparsely strigillose on lamina and densely strigillose along veins on both surfaces, base cuneate to truncate, stipe 10–25 mm, apex obtuse to shortly acuminate. Corolla yellow, salverform, densely strigillose outside; tube 18–25 mm, densely yellow clavate pubescent inside upper part; lobes ovate, 3.5–4 mm, adaxially densely yellow papillose, acute to shortly acuminate. Berry ellipsoid, 1–1.2 × 0.4–0.6 cm, sparsely strigillose, on pedicels or stipes to 6 mm. Fl. May–Sep, fr. Oct.

Thickets at riversides, in fields, or in valleys; near sea level to 1400 m. Guangdong, Guangxi, Guizhou, Hubei, Sichuan, Yunnan [Vietnam].

The illustration of this species presented by H. H. Hsue and H. Wu (in FRPS 71(1): 304, t. 80, f. 1–3. 1999) is difficult to separate from the plants included here in *Mussaenda frondosa*.

- 1a. Branches and abaxial surface of leaf  
blades sparsely pubescent ..... 7a. var. *divaricata*  
1b. Branches and abaxial surface of leaf  
blades densely pubescent ..... 7b. var. *mollis*

**7a. *Mussaenda divaricata* var. *divaricata***

展枝玉叶金花(原变种) zhan zhi yu ye jin hua (yuan bian zhong)

Branches sparsely pubescent. Leaf blade sparsely pubescent abaxially. Fl. Jun–Sep.

• Thickets at riversides or in fields; near sea level to 1200 m. Guangdong, Guangxi, Guizhou, Hubei, Sichuan, Yunnan.

**7b. *Mussaenda divaricata* var. *mollis*** Hutchinson in Sargent, *Pl. Wilson.* 3: 398. 1916.

柔毛玉叶金花 rou mao yu ye jin hua

Branches densely pubescent. Leaf blade densely pubescent abaxially. Fl. May, fr. Oct.

Thickets in valleys; ca. 1400 m. Yunnan [Vietnam].

**8. *Mussaenda elliptica*** Hutchinson in Sargent, Pl. Wilson. 3: 395. 1916.

椭圆玉叶金花 tuo yuan yu ye jin hua

Shrubs, 1–2 m tall; branchlets terete, sparsely strigillose. Leaves opposite; petiole 0.7–1 cm, strigillose to strigose; blade drying thinly papery, elliptic, 6–20 × 3–10 cm, both surfaces glabrous to strigillose at least on veins, base rounded to cuneate, apex acuminate; secondary veins 6 or 7 pairs, tertiary venation apparently reticulate; stipules deciduous, ovate-triangular, ca. 8 mm, sparsely puberulent, deeply 2-lobed, lobes narrowly triangular, acuminate. Inflorescence congested-cymose, ca. 1.5 × 1.5 cm, strigillose or strigose, subsessile to pedunculate; bracts linear-subulate, to 8 mm. Flowers pedicellate, biology not noted. Calyx strigillose; hypanthium portion turbinate, ca. 2 mm; lobes subulate, 6–7 mm, with 2 lobes on 2–5 flowers per inflorescence expanded into white calycophyll, blade broadly ovate, 5–7.5 × 3.5–5 cm, strigillose along veins, base obtuse to truncate, stipe 7–15 mm, apex acute to shortly acuminate. Corolla yellow, salverform, outside strigose; tube ca. 20 mm, densely yellow clavate pubescent inside upper part; lobes triangular-ovate, ca. 3 mm, mucronate with appendage ca. 1 mm. Berry unknown. Fl. May–Jun.

• Forests in valleys, forest margins; 600–1000 m. Guangxi, Sichuan, Yunnan.

It is implied in the protologue that the stipules are entire, but on an isotype specimen (*E. H. Wilson 4604*, US – bar code 00137848, Web!) they are deeply bilobed; also the protologue described the inflorescences as pedunculate, but they are subsessile on this isotype. In FRPS (71(1): 302. 1999), the leaves were described as sparsely pubescent and the calyx lobes as 4.5–5.5 mm, but in the protologue they were described as glabrous and 6–7 mm, respectively.

**9. *Mussaenda emeiensis*** Z. Y. Zhu & S. J. Zhu, Bull. Bot. Res., Harbin 28: 257. 2008.

峨眉玉叶金花 e mei yu ye jin hua

Weak shrubs, to 5 m tall; branches compressed, shortly pubescent. Leaves opposite; petiole 2–3.5 cm, shortly pubescent; blade drying thickly papery, green adaxially, pale abaxially, 7–18(–20) × 4.5–12(–15) cm, both surfaces pilose on veins to glabrescent, base obtuse to acute, apex acute to acuminate; secondary veins 7–9 pairs; stipules triangular-ovate to broadly ovate, 6–7 mm, shortly pubescent, acute to cuspidate or 2-lobed. Inflorescence cymose or fasciculate, ca. 1 × 1.5 cm, many flowered, densely pubescent, sessile; bracts ovate-lanceolate, 4–10 mm, acuminate; pedicels ca. 2 mm. Flowers pedicellate, biology not noted. Calyx obovoid, ca. 4 mm, pilosulous; lobes oblong-lanceolate to lanceolate, 8–10 × 2–2.5 mm, pilosulous, acute, with 1 lobe in ca. 2 flowers per inflorescence expanded into calycophyll, blade ovate to elliptic, 2.5–5.5 cm, pubescent to glabrous, base obtuse, stipe 8–10 mm, apex obtuse to acute. Corolla yellow or orange, tubular, outside densely pubescent; tube 10–11 mm, inside densely clavate pilose; lobes broadly ovate, 3–4 mm, inside verrucose, acute to acuminate. Berry ellipsoid, ca. 10 × 8 mm, pilosulous to glabrescent, calyx limb deciduous.

• Mixed forests on slopes; 700–900 m. Sichuan (Emei Shan).

**10. *Mussaenda erosa*** Champion ex Bentham, Hooker's J. Bot. Kew Gard. Misc. 4: 193. 1852.

楠藤 nan teng

Climbing shrubs, to 5 m tall; branches glabrous, terete, sparsely lenticellate. Leaves opposite; petiole 0.3–1.5 cm, glabrous; blade drying thickly papery, brown, ovate, oblanceolate, lanceolate, or oblong-elliptic, 5.5–14 × 2.4–6 cm, both surfaces glabrous or sparsely strigose on principal veins, base acute, cuneate, or occasionally obtuse, apex acute to acuminate; secondary veins 4–6 pairs, without domatia, tertiary venation only sparsely visible abaxially; stipules caducous exposing a fringe of persistent reddish brown trichomes, narrowly triangular, 3–8 mm, glabrous, deeply 2-parted, lobes acute to acuminate. Inflorescence compound-cymose to compound-corymbiform, 2–8 × 2–12 cm, congested when young becoming lax with age, glabrous, pedunculate or sessile and 3- or 5-partite; peduncles 1–2.5 cm; bracts triangular to linear-lanceolate, 1.5–7 mm, sparsely strigillose to glabrous; pedicels 1–5 mm. Flowers pedicellate, biology not noted. Calyx with hypanthium portion ellipsoid, 2.5–3.5 mm, glabrous; lobes linear-lanceolate to narrowly triangular, 2–4.5 mm, often unequal on an individual flower, strigillose or hispidulous, with 1 lobe on 1–6 flowers per inflorescence expanded into white calycophyll, blade broadly elliptic to ovate, 3.5–6.5 × 3–5 cm, glabrous except sparsely strigillose on principal veins, base cuneate, rounded, or truncate, stipe 9–20 mm, apex rounded to acute. Corolla yellow to orange-yellow, outside densely strigillose to strigose; tube 22–24 mm; lobes ovate, 4–5 mm, adaxially yellow papillose, rounded then abruptly shortly acuminate. Berry ellipsoid to subglobose, 10–13 × 8–10 mm, glabrous, smooth or sparsely lenticellate, calyx limb deciduous. Fl. Apr–Jul, fr. Sep–Dec.

Sparse evergreen forests, streamsides, along roads; 300–800 m. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Sichuan, Taiwan, Yunnan [Japan (Ryukyu Islands), Vietnam].

**11. *Mussaenda frondosa*** Linnaeus, Sp. Pl. 1: 177. 1753.

洋玉叶金花 yang yu ye jin hua

Climbing shrubs; branches terete to compressed, moderately to densely pale red sericeous to hirsute becoming glabrescent, red-brown or brown, rather densely lenticellate. Leaves opposite; petiole 4–10 mm, densely sericeous; blade drying thinly papery or leathery, adaxially dark green to brownish green, abaxially pale green to yellowed, broadly elliptic, elliptic-oblong, ovate, or oblanceolate, 8–15 × 3–8 cm, both surfaces sparsely strigillose on lamina and strigose to sericeous on principal veins, base acute, obtuse, or rounded, apex acute to caudate-acuminate; secondary veins 7–10 pairs, tertiary venation visible and reticulate; stipules persistent, triangular, 5–10 mm, densely strigose to pilose, deeply 2-lobed, lobes lanceolate to narrowly triangular, acute to acuminate. Inflorescences congested-cymose becoming lax with lateral axes elongating markedly, 4–8 × 8–20 cm with lateral axes to 8 cm, sparsely to moderately pubescent with 2 types of pubescence, mixed strigillose to appressed puberulent and hirsute to villous, pedunculate or sessile and 3-partite; peduncles 1–3 cm; bracts triangular

or elliptic, 4–10 mm, usually 2- to multifid, acute to acuminate; pedicels 1–6 mm. Flowers pedicellate, biology not noted. Calyx with hypanthium portion ellipsoid, 3–4 mm, strigose to sericeous; lobes narrowly triangular to narrowly ligulate, 7–12 mm, hirsute, acute to acuminate, with 1 lobe of 1–4 flowers per inflorescence sometimes expanded into calycophyll, blade elliptic-oblong to ovate, 6–8 × 2.5–5 cm, both surfaces glabrescent on lamina and strigillose on principal veins, base acute to cuneate, stipe 10–30 mm, apex acute or acuminate. Corolla salverform, outside hirsute; tube 22–25 mm; lobes ovate, 6–7 mm, acuminate. Berry ovoid or ellipsoid, ca. 10 × 7 mm, strigose to glabrescent, calyx limb deciduous. Fl. Apr–May.

Cultivated in Guangdong and Hainan [native to Cambodia, India, Indonesia, Sri Lanka, and Vietnam].

**12. *Mussaenda hainanensis*** Merrill, Lingnan Sci. J. 14: 58. 1935.

海南玉叶金花 hai nan yu ye jin hua

Climbing shrubs; branches terete, densely ferruginous- or gray villosulous to tomentulose. Leaves opposite; petiole 2–5 mm, densely velutinous to hirtellous; blade drying papery, adaxially dark green, abaxially pale, oblong-elliptic, obovate, or lanceolate, 3–12 × 1.5–4 cm, adaxially sparsely to densely villosulous to strigillose or hispid, abaxially densely villosulous or tomentulose, both surfaces with pubescence denser along principal veins, base cuneate to acute, apex acute to shortly acuminate; secondary veins 7 or 8 pairs, tertiary venation visible and reticulate; stipules persistent, triangular to ovate, 3–7 mm, densely pilosulous to villosulous, entire or usually deeply 2-lobed, lobes lanceolate to linear, acuminate. Inflorescence subcapitate to congested-cymose, 3–5 × 3–5 cm, densely pilosulous to villosulous, pedunculate or sessile and 3-partite; peduncle 1–3 cm; bracts linear-lanceolate, 3–6 mm. Flowers sessile or subsessile, biology not noted. Calyx densely strigose to sericeous or pilose; hypanthium portion ellipsoid to turbinate, 1.5–2 mm; lobes linear-lanceolate to narrowly elliptic, 6–8 mm, acute to acuminate, with 1 lobe on 1 or 2 flowers per inflorescence expanded into calycophyll, blade broadly elliptic to ovate, 1.5–4 × 1–3.5 cm, moderately to sparsely strigillose or sericeous, base obtuse, truncate, or cordulate, stipe 10–16 mm, apex acute. Corolla yellow, salverform, densely strigose outside; tube 20–25 mm; lobes triangular-ovate, 3–5 mm, adaxially densely yellow papillose, acuminate. Berry ellipsoid to ellipsoid-oblong, 18–20 × 11–12 mm, pilosulous to hirtellous, densely lenticellate, somewhat woody, with calyx limb deciduous, with pedicels sometimes elongating, to 4 mm. Fl. Mar–Jun, fr. Jul–Aug.

- Forests at middle elevations; 300–800 m. Hainan.

The protologue and H. H. Hsue and H. Wu (in FRPS 71(1): 297. 1999) described the “calyx tube” as 3–4 mm, but this has not been seen on specimens studied.

**13. *Mussaenda hirsutula*** Miquel, J. Bot. Néerl. 1: 109. 1861.

粗毛玉叶金花 cu mao yu ye jin hua

*Mussaenda inflata* H. S. Hsue & H. Wu.

Climbing shrubs; branches terete, densely ferruginous- or gray villosulous, hirtellous, or tomentulose. Leaves opposite;

petiole (2–)3–15 mm, moderately to densely villosulous, tomentulose, or velutinous; blade drying papery to subleathery, abaxially pale, oblong-elliptic, lanceolate, or ovate, (4–)7–13 × (2–)2.5–4 cm, adaxially sparsely to moderately hirtellous or hispid with pubescence usually denser along principal veins, abaxially moderately to densely villosulous, hirtellous, or strigose-hirsute, base acute, cuneate, or rounded, apex acute or acuminate; secondary veins 5–8 pairs, tertiary venation visible and reticulate; stipules persistent (or in *M. inflata* form deciduous), triangular, (4–)5–10 mm, densely strigose, villosulous, or pilose, deeply 2-lobed, lobes lanceolate, narrowly triangular, or linear. Inflorescence subcapitate to congested-cymose, (1–)1.5–4 × 1.5–4 cm, densely villosulous to hirsute, pedunculate; peduncle 0.3–1.5 cm; bracts linear-lanceolate, 4–6 mm. Flowers subsessile or sessile, biology not noted. Calyx sparsely to densely villosulous or villous; hypanthium portion ellipsoid to subglobose, 1.5–2 mm; lobes linear to narrowly triangular, (4–)7–10(–13) mm, sometimes 1 lobe on 1–3 flowers per inflorescence expanded into calycophyll, blade broadly elliptic to ovate, (2.5–)4–6 × (2–)3–5 cm, sparsely strigillose to villosulous with pubescence usually denser on veins, base cuneate to rounded, stipe 10–14 mm, apex rounded or acute. Corolla yellow to orange-yellow, salverform, outside densely strigose to sericeous; tube cylindrical and 26–28 mm (or constricted in throat and 18–19 mm in *M. inflata* form); lobes elliptic to lanceolate, 4–6 mm, adaxially densely yellow papillose, acute to acuminate. Berry ellipsoid or subglobose, 14–20 × 9–12 mm, lenticellate, with calyx limb persistent, with pedicels sometimes elongating, to 4 mm. Fl. Apr–Jun (Nov in *M. inflata* form), fr. Jul–Jan of following year.

- Thickets in fields, at streamsides, or in valleys, often on tree crowns; 300–800 m. Guangdong, Guizhou, Hainan, Hunan, Yunnan.

The name *Mussaenda inflata* was based on a single specimen distinguished primarily by a notably swollen corolla. Deng and Zhang (Acta Phytotax. Sin. 44: 608–609. 2006) studied this and concluded that *M. inflata* is a synonym of *M. hirsutula* and was described based on a specimen with malformed corollas. In the description above, in general, the measurements in parentheses apply only to the plants previously included in *M. inflata*.

**14. *Mussaenda hossei*** Craib, Beih. Bot. Centralbl. 28(2): 444, 457. 1911.

红毛玉叶金花 hong mao yu ye jin hua

*Mussaenda rehderiana* Hutchinson.

Shrubs, to 2 m tall; branches densely whitened, reddish, or brownish villosulous, tomentulose, or villous, terete, sometimes becoming glabrescent. Leaves opposite; petiole 0.5–3 mm, villosulous to villous; blade drying thickly papery, oblanceolate, oblong-oblanceolate, elliptic, lanceolate, or ovate, 3–14 × 1.5–4 cm, adaxially sparsely to densely pilosulous to villosulous, abaxially densely hirtellous, villosulous, or villous, base obtuse, subcordate, or rounded, apex acuminate or acute; secondary veins 8–10 pairs, tertiary venation not readily visible; stipules usually persistent, lanceolate to triangular, 5–7 × 2–3 mm, densely strigose, villosulous, or villous, entire or usually 2-lobed for up to 1/2, segments acute to acuminate. Inflorescence congested-cymose, densely tomentose to villous, pedunculate or

sessile and 3(or 5)-partite; peduncle 1–5 cm; bracts lanceolate, narrowly triangular, or linear, 1–10 mm; pedicels to 1 mm. Flowers subsessile to shortly pedicellate, biology not noted. Calyx densely villosulous to hirtellous; hypanthium portion subellipsoid to oblanceoloid, 2–2.5 mm; lobes lanceolate to narrowly triangular, 2–2.2 mm, acute, with 2 lobes on 4–6 flowers of each inflorescence expanded into white calycophyll, blade elliptic to suborbicular, 2–5.5 × 2–4 cm, base cuneate to cordulate, stipe 12–15 mm, apex obtuse or rounded and shortly acuminate. Corolla orange-yellow, salverform, outside densely pilosulous, villosulous, or tomentulose; tube 20–26 mm; lobes suborbicular, 2.5–3 mm, obtuse then abruptly acuminate or acute. Berry oblong-ellipsoid, ca. 18 × 8 mm, calyx lobes persistent. Fl. Nov–Mar.

Forests; 600–1600 m. S Yunnan [Laos, Myanmar, Thailand, Vietnam].

In the protologue, Craib noted variation in density of the pubescence among the few specimens he studied; continuous variation in density and length of the trichomes is evident among the specimens collected since then.

**15. *Mussaenda kwangsiensis*** H. L. Li, J. Arnold Arbor. 24: 455. 1943.

广西玉叶金花 *guang xi yu ye jin hua*

Climbing shrubs; branches terete, densely strigillose, sometimes with congested groups of leaves borne on reduced axillary buds. Leaves opposite; petiole 5–8 mm, appressed pubescent; blade drying thinly papery, oblong-lanceolate or lanceolate, 8–11 × 2.5–4 cm, adaxially sparsely strigillose with pubescence denser along veins, abaxially densely villous, sparsely villosulous, or hirtellous, base attenuate or cuneate, apex acuminate or shortly acuminate; secondary veins 6–8 pairs, with tertiary venation not readily visible; stipules caducous, deeply 2-parted, lobes linear, ca. 6 mm. Inflorescence congested-cymose, ca. 4 cm, moderately to densely strigillose; bracts linear, 5–15 mm. Flowers densely grouped, sessile, biology not noted. Calyx with hypanthium portion ellipsoid, ca. 5 mm, densely pubescent; lobes linear, 25–30 × 1–2 mm, sparsely pilose, with 1 lobe on 1(or ?more) flower in each inflorescence enlarged into white calycophyll, blade ovate, ca. 6 cm, sparsely pubescent on both surfaces, base rounded, stipe ca. 8.5 mm, apex acuminate. Corolla yellow, slenderly salverform, outside gray pubescent; tube 20–25 mm; lobes ovate, ca. 3 × 1.5 mm, adaxially densely yellow papillose, acuminate, acute, or mucronate. Berry not seen. Fl. Sep–Jan.

• Sparse forests at streamsides in valleys. Guangxi.

**16. *Mussaenda kwangtungensis*** H. L. Li, J. Arnold Arbor. 25: 427. 1944.

广东玉叶金花 *guang dong yu ye jin hua*

Climbing shrubs, 1–2.5 m tall; branches terete, brown, densely strigillose becoming glabrescent. Leaves opposite; petiole 3–5 mm, strigillose; blade drying thinly papery, lanceolate-elliptic to elliptic-oblong, 3–9 × 1–3 cm, adaxially sparsely strigillose to glabrescent, abaxially sparsely to densely strigillose or strigillose with pubescence denser along principal veins, base acute to obtuse, apex acute to acuminate with tips to 1 cm; sec-

ondary veins 3–6 pairs, apparently without domatia, tertiary venation not visible; stipules caducous, 1.5–3 mm, densely strigillose, deeply 2-lobed, lobes linear, 1.5–2 mm. Inflorescence compact-cymose to subcapitate, ca. 1 × 1–1.5 cm, few to several flowered, densely strigillose, pedunculate; peduncles 2–10 mm; bracts linear, ca. 1 mm. Flowers subsessile, biology not noted. Calyx strigillose to glabrescent; hypanthium portion ellipsoid, 2–3 mm; lobes linear, 2.5–3.5 mm, with 1 lobe on 2–4 flowers per inflorescence sometimes expanded into calycophyll, blade oblong-ovate, elliptic, or elliptic-ovate, 3.5–5 × 1.5–2.5 cm, strigillose, base cuneate, stipe 12–15 mm, apex acute to obtuse. Corolla yellow, salverform, outside strigose to strigillose; tube (31–)39–42 mm; lobes ovate, 4.5–5 mm, adaxially densely yellow papillose, acuminate. Berry not seen. Fl. May–Sep.

• Thickets on mountains. S Guangdong.

**17. *Mussaenda laxiflora*** Hutchinson in Sargent, Pl. Wilson. 3: 399. 1916.

疏花玉叶金花 *shu hua yu ye jin hua*

Shrubs, to 3 m tall; branches terete, densely strigillose, strigose, or appressed tomentose. Leaves opposite; petiole 4–10 mm, densely strigillose or appressed tomentulose; blade drying papery, elliptic, obovate, or obovate-oblong, 6.5–14 × 2.5–5 cm, adaxially sparsely strigillose especially along veins, abaxially densely strigillose to strigose along veins and glabrescent on lamina, base cuneate, apex caudate to acuminate; secondary veins 6–9 pairs, apparently without domatia, tertiary venation visible and subparallel; stipules deciduous, 4–8 mm, densely strigillose, deeply 2-lobed, lobes narrowly triangular, acute. Inflorescences congested to laxly cymose, 2–5 × 3–7 cm, densely strigose to strigillose, pedunculate or sessile and tripartite; peduncle 20–25 mm; bracts linear, 1–10, usually caducous; pedicels 1–5 mm. Flowers pedicellate in umbelliform groups of 2 or 3, biology not noted. Calyx moderately to densely strigose; hypanthium portion narrowly ellipsoid to turbinate, ca. 3 mm; lobes linear to narrowly triangular, 5–7 mm, with 1 lobe in 1–3 flowers per inflorescence sometimes expanded into calycophyll, blade lanceolate or ovate, 3.5–7 × 1.5–2.5 cm, sparsely strigillose with pubescence usually denser on veins, base cuneate to obtuse, stipe 10–12 mm, apex acute to subacuminate. Corolla yellow or orange-yellow, salverform, outside densely sericeous; tube 26–30 mm, inside densely yellow clavate pubescent in upper part; lobes triangular-lanceolate, 3–4 mm, adaxially densely yellow papillose, acuminate to long acuminate. Berry ellipsoid, ca. 1 cm, sparsely pubescent. Fl. Jun–Jul, fr. Aug–Dec.

• Forests, thickets; ca. 1600 m. Yunnan.

**18. *Mussaenda lotungensis*** Y. H. Chun & W. C. Ko, Fl. Hainan. 3: 581. 1974.

乐东玉叶金花 *le dong yu ye jin hua*

Climbing shrubs; branches terete, sparsely strigillose to glabrescent. Leaves opposite; petiole 4–12 mm, moderately to densely strigillose; blade drying papery, lanceolate or oblong-lanceolate, 5–10 × 1.5–3 cm, adaxially glabrous or sparsely strigillose along principal veins, abaxially sparsely strigillose to glabrous with pubescence denser along veins, base cuneate or obtuse, apex acuminate; secondary veins 4 or 5 pairs, tertiary

venation subparallel; stipules deciduous, triangular, 3–6 mm, moderately strigillose, deeply 2-lobed, lobes narrowly triangular to subulate. Inflorescences terminal on main stems and sometimes short lateral stems, congested to somewhat laxly cymose, 1–3 × 1.5–3 cm, moderately to densely strigillose and strigose, pedunculate; peduncles 1.5–2 cm; bracts triangular, 3–3.5 mm; pedicels 1–3 mm. Flowers pedicellate, biology not noted. Calyx with hypanthium portion ellipsoid to subturbinate, 2–2.5 mm, sparsely strigillose; lobes narrowly triangular, 1.5–2.5 mm, densely strigillose, with 1 lobe on 1–3 flowers per inflorescence expanded into calycophyll, blade narrowly oblong-elliptic to oblanceolate, 3–4 × 0.8–1.2 cm, both surfaces sparsely to moderately strigillose, base acute, stipe 5–16 mm, apex obtuse or acute. Corolla yellow, salverform, outside moderately to densely strigillose; tube 13–15 mm, with yellow clavate pubescence in throat; lobes triangular to ovate, ca. 2 mm, adaxially densely yellow papillose, acuminate. Berry unknown. Fl. Apr–Jun.

- Wet soil in dense forests. Hainan (Ledong).

**19. *Mussaenda macrophylla*** Wallich in Roxburgh, Fl. Ind. 2: 228. 1824.

大叶玉叶金花 da ye yu ye jin hua

*Mussaenda hispida* D. Don; *M. kotoensis* Hayata.

Erect or climbing shrubs; branches terete to quadrangular, sparsely to moderately sericeous. Leaves opposite; petiole 4–35 mm, sparsely hirsute to glabrescent; blade drying membranous to papery, green to brownish, paler below when specimen well preserved, elliptic-oblong, elliptic, or ovate, 12–21 × 8–11 cm, both surfaces sparsely strigillose to pilose on lamina and moderately hirsute along principal veins, base cuneate to obtuse, apex acute to acuminate; secondary veins 6–8 pairs, without domatia, tertiary venation reticulate; stipules deciduous, ovate to triangular, 5–8 mm, sparsely brown hirsute to glabrescent, deeply 2-lobed, lobes acute to acuminate. Inflorescences laxly cymose, 6–15 cm, hirsute, sessile with arching lateral axes; bracts lanceolate or 2- or 3-parted, 5–10 mm, obtuse to acuminate. Flowers subsessile, biology not noted. Calyx with hypanthium portion campanulate to obconic, 3–4 mm, densely brown strigose to sericeous; lobes lanceolate, ligulate, or oblanceolate, 4–11 × 1.5–3 mm, often unequal on an individual flower, densely to moderately strigillose to strigose, acute, with 1 lobe on 1 to several flowers in each inflorescence expanded into white calycophyll, blade broadly ovate or rhombic, 5–12 cm, both surfaces sparsely hirsute to glabrescent on lamina and moderately to densely pilosulous to puberulent on principal veins, base obtuse to truncate, stipe 18–37 mm, apex obtuse to shortly acuminate. Corolla orange-yellow to golden yellow, salverform, outside densely sericeous; tube 20–25 mm; lobes ovate, 7–10 mm, acute to acuminate. Berry ellipsoid, 10–15 mm, strigose, lenticellate, calyx limb deciduous. Fl. Jun–Jul, fr. Aug–Nov.

Thickets or forests on mountains; sea level to 1300 m. Guangdong, Guangxi, Taiwan [Indonesia, Malaysia, Philippines].

This species is circumscribed somewhat differently here than by H. H. Hsue and H. Wu (in FRPS 71(1): 287–289. 1999); see comments under *Mussaenda treuteri*.

**20. *Mussaenda membranifolia*** Merrill, Philipp. J. Sci. 23: 267. 1923.

膜叶玉叶金花 mo ye yu ye jin hua

Climbing shrubs; branches terete, glabrous. Leaves opposite; petiole 3–30 mm, hispid to strigillose; blade drying membranous, oblanceolate, elliptic, or elliptic-oblong, 9–15 × 2.5–4.5 cm, both surfaces sparsely strigose with pubescence denser along veins abaxially, base obtuse to acute, apex long acuminate; secondary veins 6–9 pairs, tertiary venation visible, reticulate; stipules generally deciduous, triangular, 3–5 mm, strigose, deeply 2-lobed, lobes linear. Inflorescences laxly dichotomous, 10–12 × 10–13 cm, strigillose to glabrescent, pedunculate or apparently sessile and tripartite; peduncles 4.5–6 cm; bracts linear, ca. 3 mm; pedicels 0.5–1 mm. Flowers pedicellate (or borne on higher order inflorescence axes), biology not noted. Calyx glabrous; hypanthium portion subellipsoid, 2–2.5 mm; lobes linear, 3–4 mm, with 1 lobe on 1 flower per inflorescence expanded into calycophyll, blade ovate to elliptic, 3–7.5 × 2–5 cm, strigose along veins on both surfaces, base cuneate to obtuse, stipe ca. 22 mm, apex acute to subacuminate. Corolla white, slenderly salverform, outside sparsely strigose; tube ca. 32 mm, densely yellow clavate pubescent in throat; lobes lanceolate or ovate-lanceolate, ca. 4 mm, adaxially yellow papillose, acute to acuminate. Berry subglobose or ellipsoid, 10–13 × 5–7 mm, glabrous, calyx lobes caducous. Fl. Apr–Jun, fr. Aug–Oct.

- Humid sites in forests. Hainan.

**21. *Mussaenda mollissima*** C. Y. Wu ex H. H. Hsue & H. Wu, Acta Phytotax. Sin. 24: 235. 1986.

多毛玉叶金花 duo mao yu ye jin hua

Shrubs, 1–7 m tall; branches terete, densely pale yellow-to brown tomentose, -hirtellous, or -hirsute. Leaves opposite; petiole 9–12 mm, sparsely to moderately strigose, hirtellous, or hirsute; blade drying subleathery, elliptic, broadly elliptic, or broadly ovate, 8–11 × 4–7.2 cm, both surfaces densely pale yellow tomentose to -hirtellous, base cuneate or obtuse, apex acute to shortly acuminate; secondary veins 9 or 10 pairs, apparently without domatia, tertiary venation reticulate to subparallel; stipules deciduous, ovate, ca. 6 mm, densely tomentose, deeply 2-lobed, lobes linear, ca. 3.5 mm. Inflorescence congested-cymose to subcapitate, ca. 4 × 4 cm, densely tomentose to hirtellous; peduncles 3–4 cm; bracts lanceolate, ca. 6 mm. Flowers subsessile, biology not noted. Calyx densely tomentose to hirtellous; hypanthium cylindrical to ellipsoid, 2.5–3.5 mm; lobes narrowly lanceolate to narrowly triangular, 3–4 mm, with 1 lobe in 1–4 flowers per inflorescence sometimes expanded into calycophyll, blade elliptic to obovate, ca. 5.5 × 2.8 cm, densely tomentose, base acute, stipe ca. 14 mm, apex obtuse to acute. Corolla orange, salverform, outside densely yellowish brown villous; tube ca. 22.5 mm, inside densely yellow clavate pubescent in upper part; lobes ovate, ca. 4 mm, adaxially densely yellow papillose, acuminate. Berry ellipsoid, ca. 12 × 9 mm, sparsely tomentose to hirtellous. Fl. May, fr. Jun.

- Forest margins, roadsides. S Yunnan.

**22. *Mussaenda multinervis*** C. Y. Wu ex H. H. Hsue & H. Wu, *Acta Phytotax. Sin.* 24: 237. 1986.

多脉玉叶金花 duo mai yu ye jin hua

Shrubs, 2–3 m tall; branches terete to angled, densely white pubescent to glabrescent. Leaves opposite; petiole ca. 3 cm, sparsely pubescent; blade drying membranous, adaxially drying pale green, abaxially gray, broadly elliptic or broadly ovate, 16–22 × 8.5–12 cm, adaxially sparsely appressed pubescent with pubescence denser on principal veins, abaxially glabrescent except densely appressed pubescent on principal veins, base acute, apex acute; secondary veins 11 or 12 pairs; stipules ovate-lanceolate, ca. 13 mm, acuminate and shortly 2-lobed. Inflorescence congested-cymose, ca. 4 × 8 cm, densely pale gray pilose, pedunculate or sessile and tripartite; bracts lanceolate, ca. 9 mm; pedicels ca. 1 mm. Flowers pedicellate, biology not noted. Calyx sparsely pubescent; hypanthium portion urceolate to ellipsoid, ca. 2.5 mm; lobes lanceolate, ca. 2 mm, with 1 lobe in ca. 3 flowers per inflorescence expanded into calycophyll, blade ovate, ca. 4 × 2.1 cm, densely pubescent along veins on both surfaces, base broadly cuneate, stipe ca. 19 mm, apex acute. Corolla pale blue, salverform, outside densely pubescent; tube ca. 23 mm, inside densely yellow clavate puberulent at upper part; lobes orbicular-ovate, ca. 2.5 mm, adaxially sparsely yellow papillose, mucronate. Berry globose, ca. 5 × 5 mm. Fl. May.

- Thickets, jungles; ca. 1500 m. S Yunnan.

The blue flowers, the lack of barbate pubescence in the throat of the tubular corolla (according to the protologue figure), and the apparently exerted stigmas (all these features are illustrated or described in the protologue) are quite anomalous features in *Mussaenda*.

**23. *Mussaenda parviflora*** Miquel, *Ann. Mus. Bot. Lugduno-Batavi* 3: 110. 1867.

小玉叶金花 xiao yu ye jin hua

*Mussaenda albiflora* Hayata; *M. parviflora* var. *formosana* Matsumura; *M. taihokuensis* Masamune.

Climbing shrubs or lianas; branches terete, sparsely to densely strigillose or glabrescent. Leaves opposite; petiole 1–2.3 cm, sparsely to densely strigillose; blade drying thickly papery, ovate, elliptic, or lanceolate, 7–15 × 2.3–6 cm, adaxially glabrous or strigillose on principal veins, abaxially sparsely to densely strigillose to appressed villous especially along veins, base acute to obtuse or subrounded, apex acuminate to caudate; secondary veins 5–7 pairs, tertiary venation rather finely reticulate; stipules usually deciduous, triangular, 5–7 mm, moderately to densely strigillose, deeply 2-lobed, lobes narrowly triangular to linear. Inflorescences laxly cymose, 4–8 × 3–8 cm, terminal and often in uppermost leaf axils, axes often somewhat scorpioid, sparsely to densely strigillose, pedunculate; peduncle 2–5 cm; bracts broadly triangular to linear, 1–7 mm, often caducous; pedicels 2–5 mm. Flowers pedicellate (or borne on higher order inflorescence axes), floral biology not noted. Calyx sparsely to densely strigillose; hypanthium portion ellipsoid to turbinate, 1.5–5 mm; lobes linear to narrowly triangular, 3–6 mm, with 1 lobe on 1–3 flowers of some inflorescences expanded into white calycophyll, blade broadly ovate or elliptic, 3–4.5 cm,

sparsely strigillose to glabrescent, base obtuse to rounded, stipe 4–10 mm, apex obtuse to shortly acuminate. Corolla yellow, salverform to tubular-funnelform, outside puberulent to glabrous; tube 5–8 mm, densely yellow clavate pubescent in throat; lobes ovate, 2–3 mm, abaxially densely yellow papillose, acute to cuspidate. Berry ellipsoid to subglobose, 10–15 mm, glabrescent, calyx limb caducous, with pedicels sometimes elongating, to 12 mm. Fl. Mar–May, fr. Aug–Dec and Jan of following year.

Forests, thickets; 100–1700 m. Guangdong, Taiwan [Japan].

**24. *Mussaenda pingbianensis*** C. Y. Wu ex H. H. Hsue & H. Wu, *Acta Phytotax. Sin.* 24: 233. 1986.

屏边玉叶金花 ping bian yu ye jin hua

Shrubs, ca. 3 m tall; branchlets glabrous. Leaves opposite; petiole ca. 6 mm, sparsely appressed pubescent; blade drying papery, adaxially shiny green, abaxially pale, elliptic or ovate, 7–8.5 × 2.5–3.2 cm, adaxially glabrous, abaxially pubescent along veins, base cuneate, apex acuminate; secondary veins ca. 7 pairs; stipules caducous to persistent, ovate, ca. 3.5 mm, pubescent, deeply 2-lobed, lobes narrowly triangular. Inflorescences congested-cymose, ca. 6 × 10 cm, many flowered, densely pubescent, sessile and tripartite or pedunculate; peduncles 1–2 cm; bracts lanceolate, 8–12 mm, densely pubescent. Flowers subsessile, biology not noted. Calyx sparsely pubescent; hypanthium portion turbinate, ca. 3 mm; lobes linear to narrowly triangular, ca. 8.5 mm, with 1 lobe in ca. 4 flowers per inflorescence expanded into white calycophyll, blade ovate to obovate, 5.5–6 cm, base obtuse to acute, stipe 10–14 mm, apex obtuse to shortly acuminate. Corolla orange to orange-red, salverform, outside sparsely to densely pubescent; tube ca. 14 mm, inside densely yellow clavate pubescent in upper part; lobes ovate, ca. 2.5 mm, adaxially densely yellow papillose, acuminate to mucronate. Berry unknown. Fl. May.

- Valleys. SE Yunnan.

The protologue described the stipules as caducous, but the protologue figure showed them as persistent. The specific epithet was written as “*pingpienensis*” by H. H. Hsue and H. Wu (in FRPS 71(1): 299. 1999), but it was originally published with the spelling above.

**25. *Mussaenda pubescens*** W. T. Aiton, *Hort. Kew.*, ed. 2, 1: 372. 1810.

玉叶金花 yu ye jin hua

*Mussaenda bodinieri* H. Léveillé & Vaniot; *M. pubescens* var. *alba* X. F. Deng & D. X. Zhang; *M. pubescens* f. *clematidiflora* Chun ex H. H. Hsue & H. Wu.

Climbing shrubs, often extensively twining; branches terete, densely strigillose and sometimes also villosulous, sometimes with congested groups of leaves borne on reduced axillary buds. Leaves opposite or perhaps rarely whorled; petiole 3–8 mm, moderately to densely strigillose; blade drying membranous or thinly papery, ovate-oblong, ovate-lanceolate, elliptic, lanceolate, or oblanceolate, 2–9 × 1–4 cm, adaxially sparsely strigillose to glabrescent on lamina and moderately to densely strigillose on veins, abaxially sparsely to densely strigillose with pubescence denser on veins, base acute to obtuse, apex

acute to slightly acuminate; secondary veins 4–7 pairs, tertiary venation reticulate; stipules usually deciduous, triangular, 3–7 mm, moderately to densely strigillose, deeply 2-lobed, lobes narrowly triangular to subulate. Inflorescences terminal, subcapitate to congested-cymose, unbranched or sometimes tripartite, 1–3 × 1–3 cm, densely strigillose to villosulous, sessile to pedunculate; peduncles 0.1–1.4 cm; bracts linear, 3–5 mm; pedicels to 1 mm. Flowers sessile or infrequently pedicellate, biology not noted. Calyx moderately to densely strigillose to strigose; hypanthium portion ellipsoid to turbinate, 1.5–3 mm; lobes linear to narrowly triangular, 3–6 mm, with 1(or 5) lobes on 1–3 flowers per inflorescence of some plants expanded into white calycophyll, blade elliptic, broadly elliptic, ovate, or lanceolate, (0.4–)2.5–5 × (0.2–)2–3.5 cm, sparsely to moderately puberulent or strigillose on both surfaces, base acute to rounded, stipe 3–28 mm, apex obtuse to acute. Corolla white or yellow, salverform, outside moderately to densely strigillose or strigose; tube 11–20 mm, densely clavate pubescent in throat; lobes oblong-lanceolate to lanceolate, 2.5–4 mm, adaxially densely golden yellow papillose, acuminate. Berry subglobose, 8–10 × 6–7.5 mm, sparsely strigillose to glabrescent, smooth or finely lenticellate, calyx limb caducous, sometimes stipitate with stipe to 5 mm. Fl. Apr–Jul, fr. Jun–Dec.

Thickets in ravines, on hill slopes, or at village margins or roadsides; below 100–900 m. Fujian, Guangdong, Guangxi, Hainan, Hunan, Jiangxi, Taiwan, Zhejiang [Vietnam].

This species is widespread, common, and morphologically variable. H. H. Hsue and H. Wu (in FRPS 71(1): 296. 1999) described the leaf arrangement as opposite or whorled, but only opposite leaves have been seen on the numerous specimens studied.

One plant from Guangdong (Gaoyao) has all five of the calyx lobes petaloid and enlarged on each flower, though these structures are smaller than calycophylls that are borne singly on a flower. These plants have been separated as *Mussaenda pubescens* f. *clematidiflora*; this case was studied by Deng and Zhang (Acta Phytotax. Sin. 44: 611. 2006), who concluded that this plant is better regarded as developmentally abnormal and formally synonymized this name here. Plants with white corollas have been separated as *M. pubescens* var. *alba*; at least a third of the specimens of *M. pubescens* studied belong to this group, and considering that this color variation is common in other Rubiaceae species the variety is not recognized taxonomically here.

**26. *Mussaenda sessilifolia*** Hutchinson in Sargent, Pl. Wilson. 3: 397. 1916.

无柄玉叶金花 wu bing yu ye jin hua

Climbing shrubs; branches subterete, pale red- or red-villous. Leaves opposite; petiole 1–3 mm, villous; blade drying thickly papery, oblong-elliptic, 6–10 × 3–4.5 cm, densely red villous on both surfaces with pubescence denser on principal veins abaxially, base rounded to subtruncate, apex subacute then abruptly narrowed and acuminate; secondary veins 9 or 10 pairs; stipules generally deciduous, ca. 8 mm, densely villous, deeply 2-lobed, lobes linear-subulate. Inflorescence congested-cymose with developed principal axes, 1.5–7.5 × 1.5–4.5 cm, densely villous, pedunculate; peduncles 0.75–2.2 cm; bracts subulate, ca. 8 mm. Flowers subsessile, biology not noted. Calyx densely villous; hypanthium portion ca. 3 mm; lobes subulate, 2–3.5 mm, with 1 lobe of 1–5 flowers of each inflores-

cence expanded into calycophyll, blade broadly ovate, 5–8.5 × 3–6.5 cm, slightly pubescent, base rounded, stipe ca. 15 mm, apex obtuse. Corolla yellow, salverform, outside densely villous; tube ca. 17 mm; lobes ovate, shortly acuminate. Berry not seen. Fl. spring.

• Forests; ca. 1300 m. S Yunnan.

The protologue described the calyx lobes as ca. 2 mm, while H. H. Hsue and H. Wu (in FRPS 71(1): 289. 1999) described them as ca. 3.5 mm.

**27. *Mussaenda shikokiana*** Makino, Bot. Mag. (Tokyo) 18: 44. 1904.

大叶白纸扇 da ye bai zhi shan

*Mussaenda anomala* H. L. Li; *M. esquirolii* H. Léveillé; *M. taiwaniana* Kanehira; *M. wilsonii* Hutchinson.

Erect or climbing shrubs, 1–3 m tall; branches terete, densely strigillose and sometimes also strigose, villosulous, or tomentulose to occasionally glabrescent. Leaves opposite; petiole 1.5–3.5 cm, moderately to densely strigillose; blade drying thinly papery, adaxially green to pale green, abaxially pale gray to whitened, broadly ovate, ovate, or broadly elliptic, 6–20 × 3.5–13 cm, both surfaces sparsely strigillose to glabrescent with pubescence denser along veins, base cuneate or usually obtuse to rounded, apex abruptly acuminate or acute; secondary veins 7–10 pairs, tertiary venation regularly areolate; stipules caducous, triangular to ovate-lanceolate, 6–10 mm, sparsely to densely strigillose, often deeply 2-lobed, segments acute. Inflorescences subcapitate becoming laxly cymose, 2–5 × 2–7 cm, densely strigillose and/or tomentulose, many flowered, sessile and tripartite or pedunculate; peduncle 1.5–3 cm; bracts deciduous, ovate, lanceolate, or bilobed, 4–10 mm, sparsely to moderately strigose to strigillose; pedicels 1–4 mm. Flowers pedicellate, biology not noted. Calyx with hypanthium portion turbinate to ellipsoid, 2.5–5 mm, densely strigose; lobes subleaf-like, white, lanceolate to ligulate, 5–10 × 2–2.5 mm, moderately to densely strigillose to strigose, acute to long acuminate, with 1 lobe of 1 or few flowers on each inflorescence (or rarely all lobes of all flowers, *M. anomala*) usually expanded into calycophyll, blade obovate, ovate, or elliptic, (2–)3–4.5 cm, glabrescent on lamina and densely villosulous to strigillose on veins, base cuneate, stipe 5–15(–25) mm, apex acute to shortly acuminate. Corolla yellow, salverform-funnelform, outside densely sericeous; tube 9–14 mm; lobes ovate, 2–3 mm, abruptly acuminate. Infructescences to 6 × 12 cm. Berry subglobose to ellipsoid, ca. 10 × 10 mm, moderately to densely strigose, sparsely lenticellate, calyx limb deciduous. Fl. May–Jul, fr. Jul–Oct.

Roadsides or sparse forests on hills; 100–1000 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hubei, Hunan, Jiangxi, Sichuan, Zhejiang [Japan].

The names *Mussaenda shikokiana* and *M. taiwaniana* were not cited by H. H. Hsue and H. Wu (in FRPS 71(1): 283–306. 1999). No differences are apparent between *M. shikokiana* and *M. esquirolii*, as noted by Japanese taxonomists (in herb.), and the latter are accordingly synonymized here.

*Mussaenda anomala* was described based on one specimen that appears to represent only an aberrant form of *M. shikokiana* with all its

calyx lobes expanded and petaloid. This name was formally synonymized by Deng and Zhang (Acta Phytotax. Sin. 44: 609–611. 2006, under *M. esquirolii*), who reported visiting the type locality where they were unable to find a similar plant.

**28. *Mussaenda simpliciloba*** Handel-Mazzetti, Anz. Akad. Wiss. Wien, Math.-Naturwiss. Kl. 62: 147. 1925.

单裂玉叶金花 dan lie yu ye jin hua

Climbing shrubs; branches subterete, grayish brown tomentose becoming glabrescent. Leaves opposite; petiole to 4 cm, glabrous; blade drying papery, adaxially dark green, abaxially pale green, broadly ovate or elliptic-ovate, 6–15 × 3–7.5 cm, both surfaces densely pubescent and villous along veins, base acute or rounded, apex acuminate; secondary veins 8 or 9 pairs; stipules triangular, ca. 6 mm, abaxially hispidulous, adaxially densely hirsute, 2-lobed. Inflorescences laxly cymose; bracts lanceolate; pedicels 2–3 mm. Flowers sessile or lateral flowers pedicellate (or on expanded axes), biology not noted. Calyx with hypanthium campanulate, ca. 4 mm, sparsely pubescent; lobes linear-lanceolate, 5–7 mm, densely pubescent, with ?1 lobe on 1 (or ?more) flower per inflorescence expanded into calycophyll, blade ovate, ca. 6 × 5–6 cm, densely pubescent along veins, base obtuse, stipe ca. 2 mm, apex acute. Corolla orange-yellow, salverform, outside pubescent; tube ca. 23 mm, densely yellow clavate pubescent inside upper part; lobes rounded, ca. 5 mm, adaxially yellow papillose. Berry globose, 8–9 × 8–9 mm, calyx limb deciduous. Fl. Jun–Jul, fr. Aug.

• Thickets in valleys or at riversides; 1200–1400 m. Guizhou, Sichuan, Yunnan.

The rounded corolla lobes described for this species are very unusual in *Mussaenda*.

**29. *Mussaenda treutleri*** Stapf, Bot. Mag. 135: t. 8254. 1909.

贡山玉叶金花 gong shan yu ye jin hua

Erect or climbing shrubs; branches terete, moderately to densely villous or hirsute. Leaves opposite; petiole 4–10 mm, hirsute or villous; blade drying membranous to papery, green to brownish, paler below when specimen well preserved, elliptic to ovate, 2.5–21 × 4–11 cm, both surfaces moderately strigillose to pilose on lamina and moderately to densely strigillose to hirsute along principal veins, base cuneate to obtuse, truncate,

or rounded, apex acute to acuminate; secondary veins 6–8 pairs, without domatia, tertiary venation reticulate; stipules generally persistent, ovate, 7–12 × 6–12 mm, moderately to densely hirsute or pilose, entire to deeply 2-lobed, segments acute to acuminate. Inflorescences subcapitate to congested-cymose or sometimes with axes later elongating, 2–6 × 2–8 cm, hirsute, sessile to subsessile; bracts lanceolate, 0.5–1 cm, obtuse to acuminate or 2- or 3-parted. Flowers subsessile, biology not noted. Calyx with hypanthium portion campanulate to obconic, 3–4 mm, densely brown strigose to -sericeous; lobes lanceolate, ligulate, or oblanceolate, 7–18 × 3–4 mm, often markedly unequal on an individual flower, densely brown strigillose to -strigose, acute, with 1 lobe on 1 to several flowers on each inflorescence sometimes expanded into white calycophyll, blade ovate or rhombic, 5–7 × 3.5–4 cm, both surfaces sparsely hirsute to glabrescent on lamina and moderately to densely pilosulous to puberulent on principal veins, base obtuse to truncate, stipe 25–37 mm, apex obtuse to shortly acuminate. Corolla orange-yellow, salverform, outside densely spreading villous; tube ca. 22 mm; lobes ovate, 5–7 mm (to 10 mm in other regions), acute to acuminate. Berry ellipsoid, 10–12 × 10–12 mm, strigose, lenticellate, calyx limb deciduous. Fl. Jul–Sep.

Thickets or dense forests on mountains; [600–]1000–1500[–2000] m. Yunnan [Bhutan, NE India, Nepal].

The description of the fruit here is based on specimens from outside our flora region.

This species is similar to *Mussaenda macrophylla*, and in the protologue *M. treutleri* was explicitly separated from plants commonly called *M. macrophylla*, both in the wild and in cultivation; in fact, the protologue noted that *M. treutleri* was already widely distributed in cultivation at that time incorrectly under the other name. *Mussaenda treutleri* subsequently has apparently still been confused with or combined with *M. macrophylla*, including by recent authors (e.g., Springate et al., Fl. Bhutan 2(2): 783. 1999). *Mussaenda treutleri* is here circumscribed somewhat differently than by H. H. Hsue and H. Wu (in FRPS 71(1): 301. 1999): the plants from montane Yunnan and adjacent regions with broad, generally persistent stipules were separated by Stapf from *M. macrophylla* and included in *M. treutleri*, and this distinction is followed here.

The illustration presented for *Mussaenda treutleri* by Fu et al. (Higher Pl. China 10: 575. 2004) is incorrect; this figure shows a species of Asteraceae.

## 57. MYCETIA Reinwardt, Syll. Pl. Nov. 2: 9. 1825.

腺萼木属 xian e mu shu

Chen Tao (陈涛); Charlotte M. Taylor

*Adenosacme* Wallich ex Miquel, nom. illeg. superfl.

Small shrubs, unarmed, usually rather succulent; bark often straw-yellow to nearly white, soft, often corky. Raphides present. Leaves opposite, sometimes weakly to markedly anisophyllous, frequently somewhat asymmetrical or falcate, apparently without domatia, often with margins crisped; tertiary venation often closely reticulate and prominulous below and frequently also above; stipules persistent with leaves or caducous, interpetiolar, triangular or sometimes leaflike, often well developed, sometimes with glands. Inflorescences terminal, pseudoaxillary, cauline, or perhaps sometimes axillary, cymose to paniculiform or subcapitate, several to many flowered, pedunculate, bracteate or bracts reduced; bracts sometimes leaflike, sometimes glandular. Flowers pedicellate, bisexual, at least usually distylous. Calyx limb deeply (4 or)5(or 6)-lobed; lobes frequently somewhat unequal, usually with sessile to stalked marginal glands. Corolla yellow or white, tubular, funnellform, salverform, or campanulate, sometimes gibbous at base, inside glabrous or usually pubescent; lobes (4 or)5(or 6), in bud valvate-induplicate. Stamens (4 or)5(or 6), inserted in throat or above mid-

dle of corolla tube in short-styled flowers, inserted near base of corolla tube in long-styled flowers; filaments short or reduced; anthers apparently dorsifixed, included or partially exerted. Ovary 2(–5)-celled, ovules numerous in each cell on fleshy axile placentas; stigmas 2(–5), included in short-styled flowers or exerted in long-styled flowers. Fruit white or perhaps brown, baccate or perhaps capsular and irregularly dehiscent, leathery to fleshy or spongy, subglobose, with calyx limb persistent; seeds numerous, small, angled, with testa somewhat granular.

About 45 species: tropical and subtropical Asia; 15 species (ten endemic) in China.

This genus was reviewed for Thailand by Fukuoka (Acta Phytotax. Geobot. 40: 107–118. 1989), for the Indian subcontinent by Deb (Bull. Bot. Surv. India 28(1–4): 114–132. 1986), and for China by H. S. Lo (Guihaia 11: 105–116. 1991). *Mycetia* is said to belong to Isertieae but also, anomalously, to have raphides. H. S. Lo (in FRPS 71(1): 314. 1999) reported that the inflorescences may sometimes be axillary, but this has not been noted by other authors; this description may be using the term “axillary” for the position elsewhere considered “pseudoaxillary.” Lo also reported that the anthers may sometimes be partially exerted, which has not been reported by other authors nor seen on specimens studied by us.

- 1a. Pedicels mostly or all 9–20 mm.
- 2a. At least some nodes with markedly anisophyllous leaves, larger leaf 3–10 × (or more) as long as smaller leaf; calyx lobes 2.5–3 mm; corolla tube 12–16 mm ..... 7. *M. gracilis*
- 2b. Leaves generally isophyllous, larger leaf at most 2 × as long as smaller leaf; calyx lobes 0.8–6 mm; corolla tube 5–10 mm (unknown in *M. yunnanica*).
- 3a. Calyx lobes 3–6 mm, markedly longer than length of hypanthium together with unlobed basal part of limb ..... 2. *M. bracteata*
- 3b. Calyx lobes 0.8–3 mm, shorter than or ± equal to length of hypanthium together with unlobed basal part of limb.
- 4a. Inflorescences terminal and pseudoaxillary; calyx lobes 0.8–1 mm ..... 4. *M. brevisepala*
- 4b. Inflorescences pseudoaxillary or possibly axillary at lower stem nodes, often below leaves; calyx lobes 2.5–3 mm ..... 15. *M. yunnanica*
- 1b. Flowers subsessile or with pedicels mostly or all 8 mm or shorter.
- 5a. At least some calyx limbs and sometimes also bracts bearing few to numerous marginal glands on short to well-developed flexuous stipes.
- 6a. Stipules elliptic-oblong, obovate, or suborbicular and narrowed to stipitate at base, at base less than 1/2 as wide as maximum width; calyx lobes with 1–3 pairs of glands ..... 14. *M. sinensis*
- 6b. Stipules lanceolate, oblong-lanceolate, or ovate, at base straight or narrowed but more than 2/3 as wide as maximum width; calyx lobes with numerous stipitate glands.
- 7a. Corolla with tube 4–6 mm; leaves moderately to densely hispidulous or hirtellous adaxially ..... 9. *M. hirta*
- 7b. Corolla with tube 7–14 mm; leaves glabrous or sparsely strigillose or hispidulous adaxially.
- 8a. Petioles 1–15 mm; calyx lobes 1–1.5 mm; corolla tube 7–10 mm ..... 6. *M. glandulosa*
- 8b. Petioles 6–60 mm; calyx lobes 1.5–4 mm; corolla tube 10–14 mm ..... 11. *M. longifolia*
- 5b. Calyx limbs and bracts without raised or stipitate marginal glands.
- 9a. Calyx lobes 1.5–2 mm; corolla tube 5–7 mm (mature corollas unknown in *M. hainanensis*).
- 10a. Calyx densely hirtellous; flowers sessile or subsessile; stipules ovate, not strongly contracted at base ..... 8. *M. hainanensis*
- 10b. Calyx glabrous; flowers pedicellate; stipules elliptic-oblong, obovate, or suborbicular, contracted to stipitate at base ..... 14. *M. sinensis*
- 9b. Calyx lobes 3–6 mm; corolla tube 7–17 mm (corolla unknown in *M. macrocarpa*).
- 11a. Stipules broadly elliptic, subovate, or suborbicular, 5–10 mm.
- 12a. Leaves glabrous on both surfaces; fruit ca. 6 mm; Yunnan ..... 12. *M. macrocarpa*
- 12b. Leaves strigillose to hirtellous abaxially; fruit 7–8 mm; Xizang ..... 13. *M. nepalensis*
- 11b. Stipules triangular, lanceolate, suborbicular, or ovate, 3–6 mm.
- 13a. Corolla tube 7–8 mm; leaves subsessile or with petioles up to 15 mm.
- 14a. Leaves subsessile; inflorescences several flowered (i.e., with 5–7 flowers) ..... 3. *M. brevipes*
- 14b. Leaves with petioles 3–15 mm; inflorescences many flowered (i.e., with 9–40 flowers) ..... 5. *M. coriacea*
- 13b. Corolla tube 10–17 mm; leaves with petioles 10–70 mm.
- 15a. Flowers sessile or subsessile; petioles 10–20 mm ..... 1. *M. anlongensis*
- 15b. Flowers pedicellate with pedicels 2.5–7 mm; petioles 20–70 mm ..... 10. *M. longiflora*

**1. *Mycetia anlongensis*** H. S. Lo, Guihaia 11: 108. 1991.

安龙腺萼木 an long xian e mu

Shrubs, ca. 40 cm tall; branches glabrous or sparsely villosulose. Leaves generally isophyllous; petiole 1–2 cm, densely

villosulose (var. *anlongensis*) or villous and sometimes with black glandular hairs at each side (var. *multiciliata*); blade drying membranous, elliptic-oblong or long elliptic, 12–17 × 5–7 cm, adaxially sparsely strigillose (var. *anlongensis*) or sparsely hirsute (var. *multiciliata*), abaxially densely villosulose at least

along midrib and lateral veins (var. *anlongensis*) or sparsely hirsute (var. *multiciliata*), base cuneate, apex acute to shortly or long acuminate; secondary veins 14–18 pairs; stipules persistent, suborbicular or elliptic, 5–6 mm, obtuse. Inflorescences terminal, congested-cymose, several to many flowered; peduncle ca. 5 mm. Flowers sessile to subsessile. Calyx glabrescent; hypanthium portion obconic, ca. 2 mm; limb lobed nearly to base; lobes narrowly triangular, ca. 6 mm. Corolla yellow, tubular, outside glabrous; tube 10–13 mm (var. *multiciliata*) or 15–17 mm (var. *anlongensis*), sparsely villosulous inside; lobes triangular, ca. 3 mm. Berries unknown. Fl. Apr–May.

• Streamsides in dense forests, sometimes on limestone hill slopes; 1200–1700 m. Guangxi, Guizhou.

H. S. Lo (in FRPS 71(1): 316. 1999) intended to describe two varieties of this species but did not provide a validating Latin description or diagnosis or designate a type for *Mycetia anlongensis* var. *multiciliata*. Chen et al. (J. Fairylake Bot. Gard. 7(2): 21. 2008) have re-evaluated these taxa with new collections; in particular, they noted that they cannot confirm the description by H. S. Lo of black glandular trichomes on the petioles in var. *multiciliata*, a character not otherwise reported from this genus and considered questionable.

- 1a. Leaves shortly acuminate at apex; petioles without black glandular hairs at base; corolla 18–20 mm ..... 1a. var. *anlongensis*  
 1b. Leaves long acuminate at apex, with tip 1–3 cm; petioles sometimes with black glandular hairs at base; corolla 13–15 mm ..... 1a. var. *multiciliata*

**1a. *Mycetia anlongensis* var. *anlongensis***

安龙腺萼木(原变种) an long xian e mu (yuan bian zhong)

Petiole without black glandular hairs at base on each side; leaf blade adaxially sparsely strigillose, abaxially densely villosulous at least along midrib and lateral veins, shortly acuminate at apex. Corolla 18–20 mm. Fl. May.

• Streamsides in dense forests; 1200–1700 m. Guizhou (Anlong).

**1b. *Mycetia anlongensis* var. *multiciliata*** H. S. Lo ex Tao Chen, K. J. Yan & D. Fang, J. Fairylake Bot. Gard. 7(2): 21. 2008.

那坡腺萼木 na po xian e mu

Petiole sometimes with black glandular hairs at each side; leaf blade sparsely hirsute on both surfaces, long acuminate at apex, with tip 1–3 cm. Corolla 13–15 mm. Fl. Apr.

• Limestone hill slopes; ca. 1200 m. Guangxi (Napo).

**2. *Mycetia bracteata*** Hutchinson in Sargent, Pl. Wilson. 3: 409. 1916.

长苞腺萼木 chang bao xian e mu

Shrubs, ca. 1 m tall; branches puberulent becoming glabrescent. Leaves generally isophyllous; petiole 0.5–1 cm, puberulent; blade drying thinly leathery to membranous, long oblanceolate or lanceolate, 9–16 × 1.5–4 cm, both surfaces glabrous except puberulent along principal veins, base attenuate or acute, apex acuminate; secondary veins 16–20 pairs; stipules

persistent, broadly triangular-ovate, 7–10 mm, veined, stiffly papery, puberulent, acute. Inflorescences terminal, laxly cymose, several flowered, puberulent; branched portion to 7 cm; bracts persistent, lanceolate or leaflike, to 1.5 cm, acuminate or shortly acuminate; pedicels 10–15 mm. Flowers pedicellate. Calyx glabrescent; hypanthium portion obconic, ca. 2 mm; limb deeply lobed; lobes 5 or 6, filiform, 3–6 mm. Corolla yellow, in bud glabrous, ca. 10 mm. Berries not seen.

• About 1300 m. Yunnan (Simao).

**3. *Mycetia brevipes*** F. C. How ex S. Y. Jin & Y. L. Chen, Cat. Type Spec. Herb. China (Suppl.), 188. 1999.

短柄腺萼木 duan bing xian e mu

Shrubs, ca. 1 m tall. Branchlets glabrous. Leaves generally isophyllous, subsessile; blade drying membranous and fuscous or dark brown, elliptic or obovate, 12–15 × 4.5–6.5 cm, both surfaces glabrous or puberulent on principal veins, base cuneate to obtuse, apex acuminate to caudate; secondary veins 8–11 pairs; stipules persistent, ovate, 4–5 mm, membranous. Inflorescences terminal, congested-cymose, 5–7-flowered; peduncle ca. 1.6 cm; bracts linear, ca. 3 mm; pedicels 1–3 mm. Flowers pedicellate. Calyx puberulent; hypanthium portion obconic, ca. 1.8 mm; limb lobed nearly to base; lobes linear-lanceolate, ca. 3 mm. Corolla yellow, tubular, outside glabrous; tube ca. 7 mm, sparsely villous inside; lobes broadly ovate-triangular, ca. 1.5 mm. Berries not seen. Fl. Sep.

• Bamboo forests; ca. 1500 m. NW Yunnan.

**4. *Mycetia brevisepala*** H. S. Lo, Guihaia 11: 113. 1991.

短萼腺萼木 duan e xian e mu

Shrubs, 0.5–1.5(–2) m tall; branches densely puberulent or strigillose to glabrous. Leaves generally isophyllous to slightly anisophyllous; petiole 0.2–1 cm, puberulent; blade drying thinly leathery to papery and grayish green, elliptic-oblong, elliptic, obovate, or oblong-lanceolate, 6–18 × 2.5–6 cm, adaxially glabrous and rather shiny, abaxially glabrescent or densely puberulent to hispidulous on principal veins, base cuneate to obtuse, apex acuminate; secondary veins 7–12 pairs; stipules quickly deciduous, narrowly triangular, 3–6 mm, densely puberulent to strigillose, acuminate. Inflorescences terminal becoming displaced to pseudoaxillary, laxly cymose, several flowered, puberulent to glabrous; peduncle 1–2 cm; branched portion 3–5 × 5–8 cm; bracts narrowly triangular to lanceolate, 1–3 mm; pedicels 9–20 mm. Flowers pedicellate. Calyx glabrous; hypanthium portion turbinate to subglobose, 1.2–2 mm; limb deeply lobed; lobes triangular to narrowly triangular, 0.8–1 mm. Corolla yellow, narrowly tubular, outside glabrous; tube ca. 5 mm, inside sparsely pubescent; lobes subtriangular, ca. 2 mm. Berries subglobose, 3.5–4 mm in diam. Fl. Aug–Sep, fr. Dec.

Dense forests; 200–1100 m. Yunnan [N Vietnam].

**5. *Mycetia coriacea*** (Dunn) Merrill, Philipp. J. Sci., C, 13: 159. 1918.

革叶腺萼木 ge ye xian e mu

*Adenosacme coriacea* Dunn, Bull. Misc. Inform. Kew, Addit. Ser. 10: 130. 1912.

Shrubs, 1–2 m tall; branches glabrous. Leaves isophyllous to slightly anisophyllous; petiole 3–15 cm, glabrous; blade drying thinly leathery or subpapery, lanceolate, oblanceolate, or obovate, 6–15 × 2–5.5 cm, glabrous on both surfaces, base acuminate to cuneate, apex acute or acuminate; secondary veins 8–11 pairs; stipules persistent, triangular to ovate, 3–5 mm, glabrous except sometimes ciliolate marginally, acute to acuminate. Inflorescences terminal and/or pseudoaxillary, cymose, many flowered, glabrous; peduncle 0.8–3.5 cm; branched portion 2–6 × 3–7 cm; bracts reduced or triangular, 0.5–3 mm; pedicels 0.5–3 mm. Flowers pedicellate. Calyx glabrous; hypanthium portion turbinate to obconic, 1.5–2.5 mm; limb lobed to base; lobes narrowly triangular to linear, 2.5–6 mm, sometimes unequal. Corolla pale yellow or white, tubular, outside glabrescent; tube ca. 8 mm, villous at throat; lobes triangular, ca. 2 mm. Fruit capsular, dry, ovoid to subglobose, 2.5–4 mm, irregularly dehiscent or regularly loculicidal through disk portion, with calyx lobes elongating, up to 15 mm. Fl. Apr, fr. Sep.

• Roadsides or streamsides in dense forests; 700–1200 m. S Fujian, E Guangdong.

**6. *Mycetia glandulosa*** Craib, Bull. Misc. Inform. Kew 1914: 125. 1914.

腺萼木 xian e mu

Shrubs, ca. 1 m tall; branches villosulous to hirtellous becoming glabrescent. Leaves isophyllous or slightly anisophyllous; petiole 1–8 mm, moderately to densely villosulous or hirtellous; blade drying papery, oblanceolate, oblong-oblanceolate, narrowly elliptic, or narrowly lanceolate, 7–22 × 2–5.5 cm, adaxially sparsely hispidulous, abaxially moderately to densely hirtellous, base cuneate to attenuate and often long decurrent, apex acuminate; secondary veins (7–)12–23 pairs; stipules persistent, lanceolate, 4–10 mm, densely villosulous to glabrescent, acuminate. Inflorescences terminal, congested to laxly cymose, many flowered, hirtellous to glabrous; peduncles 0.4–1.4 cm; branched portion 3–5 × 4–8 cm; bracts ovate to reniform, 1–3 mm, marginally ciliate or lacerate with stipitate glands; pedicels 1.5–5 mm. Flowers pedicellate. Calyx glabrous; hypanthium portion hemispherical to subglobose, ca. 1.5 mm; limb deeply lobed; lobes ovate to lanceolate or triangular, 1–1.5 mm, marginally fimbriate or ciliate with stipitate glands, these 0.2–0.6 mm. Corolla white or yellow, tubular, outside pilose or glabrous; tube 7–10 mm, villous inside; lobes triangular, 1–1.5 mm. Berries subglobose, ca. 5 mm in diam., subglabrous. Fl. May, fr. autumn.

Forests; 900–1500 m. Yunnan [N Thailand].

**7. *Mycetia gracilis*** Craib, Bull. Misc. Inform. Kew 1914: 125. 1914.

纤梗腺萼木 xian geng xian e mu

Shrubs, ca. 1.5 m tall; branches densely puberulent or strigillose becoming glabrescent. Leaves markedly anisophyllous; petiole 0.1–0.5 cm, densely puberulent to strigillose; blade drying thinly leathery, oblanceolate, elliptic, or narrowly lanceolate, larger 5–15 × 2–3.5 cm and smaller 1–4 × 0.5–1.5 cm, glabrous throughout or puberulent abaxially on principal veins, base acute to cuneate, apex acute to acuminate; secondary veins

8–14 pairs; stipules persistent, narrowly triangular to lanceolate, 4–8 mm, puberulent to glabrescent, acuminate. Inflorescences terminal and/or pseudoaxillary, laxly cymose, several flowered, puberulent to glabrescent; peduncle 1–2.5 cm; branched portion 2–9 × 2–8 cm; bracts linear, 1.5–3 mm; pedicels 9–15 mm. Flowers pedicellate. Calyx glabrous; hypanthium portion turbinate to obovoid, 2–2.5 mm; limb lobed to base; lobes linear to narrowly triangular, 2.5–3 mm. Corolla yellow, tubular, outside glabrous; tube 12–16 mm, pilose inside; lobes triangular to ovate, ca. 3 mm. Berries globose or slightly compressed, 4–6 mm in diam., glabrous. Fl. Aug–Sep, fr. Nov–Dec.

Streamsides in forests; 600–1300 m. S Yunnan [N Thailand, Vietnam].

**8. *Mycetia hainanensis*** H. S. Lo, Guihaia 11: 112. 1991.

海南腺萼木 hai nan xian e mu

Subshrubs, 10–25 cm tall; branches hirtellous or villosulous. Leaves generally isophyllous; petiole 1–2.5 cm, villosulous to glabrescent; blade drying papery, adaxially grayish brown or nearly grayish black, abaxially grayish brown, oblanceolate or narrowly elliptic, 5–12 × 3–4 cm, adaxially glabrous, abaxially glabrescent on lamina and villosulous on veins, base acute to attenuate, apex acute or weakly acuminate; secondary veins 9–12 pairs; stipules persistent, ovate, 5–9 mm, puberulent to glabrescent, obtuse. Inflorescences terminal, capitate or subcapitate, villosulous, sessile to pedunculate; peduncles when present 1.5–3.5 cm, villosulous; head ca. 1.5 × 1.5 cm; bracts apparently reduced. Flowers subsessile to sessile. Calyx densely hirtellous; hypanthium portion obconical-ovoid, ca. 1.5 mm; limb deeply lobed; lobes triangular-ovate, ca. 1.5 mm, obtuse. Corolla in bud white, tubular, outside hirtellous; tube to ca. 5 mm, subglabrous inside; lobes ovate, to ca. 2 mm. Berries not seen. Fl. Apr.

• Dense forests on mountains; ca. 800 m. Hainan.

**9. *Mycetia hirta*** Hutchinson in Sargent, Pl. Wilson. 3: 410. 1916.

毛腺萼木 mao xian e mu

Shrubs, 1–2 m tall; branches densely villosulous, hirtellous, or tomentose sometimes becoming glabrescent. Leaves isophyllous to slightly anisophyllous; petiole 0.7–3 cm, densely villosulous to hirtellous; blade drying papery, oblong-elliptic to elliptic or ovate, 8–25 × 3.5–9 cm, both surfaces moderately to densely hispidulous to hirtellous, base obtuse to acute and often long decurrent, apex acute to acuminate; secondary veins 12–23 pairs; stipules usually persistent with leaves, oblong-lanceolate to ovate, 0.8–2 cm, glabrous except villous along midrib and sometimes margins, acute, acuminate, or shortly 2-lobed. Inflorescences terminal, congested- to laxly cymose, several to many flowered, densely villosulous or hirtellous; peduncle 0.7–3 cm; branched portion 1.5–6 × 2.5–9 cm; bracts ovate, lanceolate, suborbicular, reniform, or stipuliform, 2–10 mm, often marginally sparsely to densely stipitate-glandular; pedicels 1.5–4 mm. Flowers pedicellate. Calyx densely hirtellous; hypanthium portion subglobose-campanulate, ca. 2 mm; limb deeply lobed; lobes broadly triangular, 2–2.5 mm, marginally densely stipitate-glandular and sometimes appearing lacerate, glands 0.3–0.6

mm. Corolla yellow, tubular, outside sparsely to densely villosulous or hirtellous; tube 4–6 mm, sparsely villous inside; lobes triangular, 1–1.8 mm. Berries capsular, subglobose, 3.5–4.5 mm in diam., densely hirtellous or villosulous. Fl. Jun–Jul, fr. Sep–Oct.

- Forests; 500–1600 m. Hainan, Yunnan.

**10. *Mycetia longiflora*** F. C. How ex H. S. Lo, *Guihaia* 11: 107. 1991.

长花腺萼木 *chang hua xian e mu*

*Mycetia longiflora* f. *howii* H. S. Lo.

Shrubs, 0.6–2 m tall; branches puberulent becoming glabrescent. Leaves generally isophyllous; petiole 2–7 cm, densely tomentulose or puberulent; blade drying thinly papery, elliptic-oblong, obovate, or elliptic, 10–25 × 4–10.5 cm, adaxially glabrous or sparsely puberulent along midrib, abaxially glabrous or puberulent to tomentulose along principal veins, base cuneate to acute and often long decurrent, apex acute to acuminate; secondary veins 10–15 pairs; stipules persistent, triangular to ovate, 3–5 mm, puberulent, obtuse, acute, or shortly 2-lobed. Inflorescences terminal, laxly cymose, densely puberulent to tomentulose, many flowered, often deflexed to pendulous; peduncle 0.3–1 cm; branched portion 4–5 × 7–10 cm; bracts reduced or narrowly triangular to lanceolate, 2–5 mm; pedicels 2.5–7 mm. Flowers pedicellate. Calyx densely puberulent, tomentulose, or glabrescent; hypanthium portion subglobose to obconic, 1.5–2.5 mm; limb lobed to base; lobes narrowly triangular to narrowly lanceolate, 4–6.5 mm. Corolla yellow, tubular, densely puberulent to glabrescent outside; tube 14–16 mm, white villous above middle inside or in throat; lobes broadly ovate-triangular, 2–2.5 mm. Berries subglobose, ca. 5 mm in diam., puberulent to glabrescent. Fl. Jul–Aug, fr. Oct–Jan.

- Dense forests; 600–1700 m. Yunnan.

Two forms of this species were separated in the protologue and by H. S. Lo in *FRPS* 71(1): 315. 1999). Lo distinguished *Mycetia longiflora* f. *howii* by its glabrous corollas and glabrous smaller leaves though no measurements were given. Presumably f. *longiflora* thus comprised plants with pubescent to subglabrous corollas and pubescent, larger leaves. The characters used to distinguish these forms vary continuously within most populations and species of Rubiaceae; accordingly, they are not recognized here.

**11. *Mycetia longifolia*** (Wallich) Kuntze, *Revis. Gen. Pl.* 1: 289. 1891.

长叶腺萼木 *chang ye xian e mu*

*Rondeletia longifolia* Wallich in Roxburgh, *Fl. Ind.* 2: 137. 1824; *Adenosacme longifolia* (Wallich) J. D. Hooker; *Wendlandia longifolia* (Wallich) Candolle.

Shrubs, to 2 m tall; branches hirtellous or villosulous becoming glabrescent. Leaves isophyllous or slightly anisophyllous; petiole 0.6–2.5(–6) cm, hirtellous or villosulous; blade drying papery, elliptic-lanceolate or elliptic, 5–18(–35) × 3–7(–10) cm, adaxially sparsely strigillose, hispidulous, or glabrous, abaxially sparsely to densely puberulent or hirtellous to glabrescent, base cuneate to acute and often decurrent, apex acu-

minate to caudate; secondary veins 13–20 pairs; stipules usually persistent, oblong-lanceolate to ovate, 5–15 mm, villosulous or hirtellous, acute to acuminate and sometimes shortly 2-lobed. Inflorescences terminal or sometimes pseudoaxillary, laxly cymose, villosulous to glabrous, subsessile to pedunculate; peduncle 0.5–1.5 cm; branched portion 3–4 × 5–6 cm; bracts elliptic to ovate, 1–3 mm, marginally sparsely stipitate-glandular; pedicels 2–5 mm. Flowers pedicellate. Calyx glabrous; hypanthium portion subglobose, 1.5–2 mm; limb deeply lobed; lobes triangular, 1.5–4 mm, with 1 or 2 pairs of stipitate glands on margins, these 0.2–0.5 mm. Corolla yellow, tubular, outside glabrous to villosulous; tube 10–14 mm, inside villous; lobes broadly ovate, 1–1.5 mm. Berries subglobose, 4–5 mm in diam., glabrescent. Fl. summer and autumn.

Forests. Xizang (Médog), S Yunnan [Bangladesh, Bhutan, NE India, Malaysia, Myanmar, Nepal].

Springate et al. (*Fl. Bhutan* 2(2): 784. 1999) observed that this species sometimes grows as an epiphyte.

**12. *Mycetia macrocarpa*** F. C. How ex H. S. Lo, *Guihaia* 11: 111. 1991.

大果腺萼木 *da guo xian e mu*

Shrubs; branches glabrous. Leaves generally isophyllous; petiole 1–1.5 cm, glabrous; blade drying papery, narrowly elliptic-oblong or narrowly lanceolate, 8–14 × 2–3.5 cm, glabrous on both surfaces, rather shiny adaxially, base cuneate, apex caudate-acuminate; secondary veins 10–12 pairs; stipules persistent, suborbicular to broadly elliptic, 7–10 mm, parallel-veined, glabrous, rounded. Inflorescences and flowers not seen. Infructescences terminal, cymose, with ca. 5 fruit. Fruit obovoid to subglobose, ca. 6 mm, with persistent calyx lobes lanceolate, 5–6 mm. Fr. Jan.

- Forests; ca. 100 m. Yunnan (Malipo).

**13. *Mycetia nepalensis*** H. Hara, *J. Jap. Bot.* 52: 198. 1977.

垂花腺萼木 *chui hua xian e mu*

Shrubs, 0.5–2 m tall; branches strigillose or hirtellous becoming glabrescent. Leaves generally isophyllous; petiole 2–4.5 cm, strigillose to hirtellous; blade drying papery, elliptic, obovate, or ovate-elliptic, 10–25 × 3.5–10 cm, adaxially glabrous or hispidulous along veins, abaxially strigillose to hirtellous, base cuneate to acute or attenuate, apex acute to acuminate; secondary veins 10–18 pairs; stipules persistent or deciduous, subovate to suborbicular, 5–10 mm, strigillose, acute and shortly 2-lobed. Inflorescences terminal, often pendulous, laxly cymose, many flowered, strigillose to glabrescent; peduncle 1–2 cm; branched portion 4–7 × 4–7 cm; bracts lanceolate to triangular, 3–10 mm; pedicels 1.5–5 mm. Flowers pedicellate. Calyx puberulent to hispidulous; hypanthium portion narrowly turbinate, 2–3 mm; limb lobed to base; lobes narrowly triangular, 3–5.5 mm. Corolla yellow to deep yellow, tubular, glabrescent outside; tube 8–12 mm, villous inside; lobes lanceolate, 1.2–2 mm. Berries subglobose, 7–8 mm in diam., glabrescent. Fl. Apr–May, fr. Aug.

Broad-leaved rain forests; ca. 1000 m. Xizang (Médog) [NE India, Nepal, ?Vietnam].

H. S. Lo (in *FRPS* 71(1): 320. 1999) reported that the calyx lobes have glands on each side at their bases, but the protologue, Springate et

al. (Fl. Bhutan 2(2): 785. 1999), and Deb (Bull. Bot. Surv. India 28(1–4): 124. 1986) said explicitly that this species does not have glands on the calyx lobes. “*Adenosacme nepalensis*” (Wallich, Numer. List, no. 6281. 1832) belongs here but is a nomen nudum and was therefore not validly published (*Vienna Code*, Art. 32.1(d)).

**14. *Mycetia sinensis*** (Hemsley) Craib, Bull. Misc. Inform. Kew 1914: 29. 1914.

华腺萼木 hua xian e mu

*Adenosacme longifolia* (Wallich) J. D. Hooker var. *sinensis* Hemsley, J. Linn. Soc., Bot. 23: 379. 1888; *Mycetia oligodonta* Merrill; *M. sinensis* f. *angustisepala* H. S. Lo.

Shrubs or subshrubs, 0.2–0.5(–1) m tall; branches densely hirtellous or strigillose to glabrous. Leaves isophyllous or slightly anisophyllous; petiole 0.2–2 cm, hirtellous or strigillose to glabrous; blade drying submembranous, usually pale, and slightly grayish green, oblong-lanceolate to elliptic-oblong, ovate, or elliptic, 8–20 × 3–5 cm, adaxially sparsely hispid to glabrous, abaxially glabrous or puberulent, hirtellous, or hispidulous at least on veins, base obtuse to cuneate then usually long decurrent, apex acute to acuminate; secondary veins 5–20 pairs; stipules usually persistent, elliptic-oblong, obovate, or suborbicular, markedly contracted to stipitate at base, 3–18 mm, sometimes veined, hispidulous, hirtellous, or glabrous, obtuse or rounded. Inflorescences terminal, laxly cymose, many flowered, glabrous, deflexed to pendulous; peduncles 3.5–7 cm; branched portion 2–7 × 2–16 cm; bracts elliptic, obovate, reniform, or stipuliform, sometimes fused in pairs, 1–3 mm, marginally entire or with stipitate glands, these 0.2–0.5 mm; pedicels 1–2.5 mm. Flowers pedicellate. Calyx glabrous; hypanthium portion subglobose to obconic, 1–2 mm; limb deeply lobed; lobes lanceolate, spatulate, or triangular, 1–2 mm, entire or with 1–3 pairs of stipitate glands. Corolla white, tubular, outside glabrous; tube 5–7 mm, inside apparently glabrous; lobes

ovate, 1.5–2 mm. Berries subglobose, 4–4.5 mm in diam., glabrous. Fl. Jul–Aug, fr. Sep–Nov.

• Streamsides or roadsides in dense forests; 200–1000 m. S Fujian, Guangdong, Guangxi, Hainan, Hunan, Jiangxi, Yunnan.

This species is said to be locally common in the notes on several specimens.

H. S. Lo (Guihaia 11: 115–116. 1991) described three forms of this species, which were recognized in FRPS (71(1): 322–323. 1999). *Mycetia sinensis* f. *angustisepala* was described from Guangxi and distinguished by its narrowly lanceolate calyx lobes that are ± as long as the “calyx tube” (i.e., the hypanthium portion together with the unlobed portion of the calyx limb); f. “*trichophylla*” (not a validly published name: *Vienna Code*, Art. 37.6) was described from Guangdong and distinguished by its leaf blades that are sparsely villous throughout; and f. *sinensis* presumably has broader and/or differently shaped calyx lobes that are longer than or shorter than the “calyx tube” and glabrous or appressed pubescent leaves. The distinctions used to separate these forms do not seem taxonomically meaningful; accordingly, these forms are not recognized here.

**15. *Mycetia yunnanica*** H. S. Lo, Guihaia 11: 116. 1991.

云南腺萼木 yun nan xian e mu

Shrubs or subshrubs, ca. 1.5 m tall; branches glabrous. Leaves generally isophyllous; petiole 1–3 cm, subglabrous; blade drying thinly leathery, elliptic, elliptic-oblong, or obovate, 10–20 × 3.5–6 cm, adaxially glabrous, abaxially glabrescent or hirtellous along midrib, base cuneate or attenuate, apex abruptly acuminate; secondary veins 12–18 pairs; stipules elliptic-oblong, 8–12 mm, glabrous, obtuse. Inflorescences and flowers not seen. Infructescences pseudoaxillary or perhaps axillary, often on lower leafless nodes, glabrous; peduncle ca. 3 cm. Berries subglobose, ca. 4 mm in diam., with persistent calyx lobes ovate-triangular, 2.5–3 × 2–2.5 mm, obtuse. Fr. Oct.

• Streamsides in forests. Yunnan (Dehong).

## 58. MYRIONEURON R. Brown ex Bentham & J. D. Hooker, Gen. Pl. 2: 69. 1873.

密脉木属 mi mai mu shu

Chen Tao (陈涛); Charlotte M. Taylor

Small shrubs, subshrubs, or large herbs, unarmed, often succulent; bark often soft or spongy, usually grayish white. Raphides absent. Leaves opposite, apparently without domatia, sometimes with crisped margins; stipules persistent or deciduous, interpetiolar, generally triangular, often closely densely parallel- to palmately veined, entire or shortly bilobed. Inflorescences terminal and/or pseudoaxillary, laxly cymose or usually congested-cymose to subcapitate, several to many flowered, sessile to pedunculate, bracteate with bracts usually well developed, often densely veined to stipuliform, sometimes outermost (i.e., basalmost) 4 or 6 bracts shortly fused at base into an involucre. Flowers sessile to pedicellate, bisexual, distylous. Calyx limb 5-lobed; lobes often densely parallel-veined. Corolla white or yellow, tubular to salverform, villous in throat; lobes 5, valvate in bud. Stamens 5, inserted in corolla tube, included or perhaps partially exerted; filaments short; anthers apparently dorsifixed, included. Ovary 2-celled, ovules numerous in each cell on presumably axile placentas; stigma 2-lobed with lobes linear, included or shortly exerted. Fruit white, baccate, fleshy to rather dry, ovoid to globose, with calyx limb persistent; seeds numerous, small, angled, with endosperm fleshy; embryo small; testa areolate.

About 14 species: Bhutan, China, India, Nepal, Vietnam; four species (one endemic) in China.

H. S. Lo (in FRPS 71(1): 309. 1999) described the inflorescences as sometimes axillary, but this has not been noted elsewhere; the term here may be used to include the position separated elsewhere as “pseudoaxillary.” Lo also reported that the anthers are sometimes partially exerted in long-styled flowers of *Myrioneuron faberi* and *M. effusum* (loc. cit.: 310, 313), which is a new condition not previously noted for the genus.

The number of pairs of lateral leaf veins described by H. S. Lo (loc. cit.: 310–313) for *Myrioneuron* species and used in part to distinguish species does not correspond to the secondary veins on specimens cited and apparently includes both secondary and intersecondary veins; thus, the

counts disagree with those of Wright (Fl. Bhutan 2(2): 786. 1999, *M. nutans*) and the illustrations of Fu and Hong (Higher Pl. China 10: 577–578. 2004), which consider only the secondary veins as done by most Rubiaceae authors.

- 1a. Corolla with tube 5–6 mm; calyx lobes 10–12 mm ..... 3. *M. nutans*  
 1b. Corolla with tube 7.5–10 mm; calyx lobes 6–14 mm.  
 2a. Shrubs; leaves with secondary veins 15–25 pairs; calyx lobes 6–7 mm ..... 1. *M. effusum*  
 2b. Herbs, sometimes becoming suffrutescent; leaves with secondary veins 9–18 pairs; calyx lobes 6–14 mm.  
 3a. Stipules 6.5–15 mm; inflorescences shortly pedunculate; corolla with tube 9–10 mm and lobes 1.5–2 mm ... 2. *M. faberi*  
 3b. Stipules 12–25 mm; inflorescences subsessile; corolla with tube 7.5–8 mm and lobes 2.5–3 mm ..... 4. *M. tonkinense*

**1. *Myrioneuron effusum*** (Pitard) Merrill, J. Arnold Arbor. 23: 195. 1942.

大叶密脉木 da ye mi mai mu

*Myrioneuron nutans* Wallich ex Kurz var. *effusum* Pitard in Lecomte, Fl. Indo-Chine 3: 192. 1923.

Shrubs, to 2 m tall; branches densely puberulent or often papillose to glabrous. Petiole 0.5–4 cm, densely puberulent; leaf blade in life adaxially dark green, abaxially pale white, drying papery, elliptic-oblong, oblanceolate, or obovate, 13–25 × 5.5–14 cm, adaxially glabrous, abaxially densely puberulent at least on veins, base acute to cuneate, apex acute; secondary veins 15–23 pairs; stipules ovate to lanceolate, 1.5–2.2 cm, densely puberulent, distinctly palmately veined, acute to shortly bilobed. Inflorescences pseudoaxillary and/or infrequently terminal, congested-cymose, subglobose to ovoid, subsessile, 1.5–2 cm; bracts lanceolate or ovate, 8–10 mm, densely puberulent, densely longitudinally veined, acuminate. Flowers subsessile. Calyx puberulent to glabrous; hypanthium portion obconic, 1.5–3 mm; limb lobed to base; lobes lanceolate to narrowly triangular or linear, 6–7 mm. Corolla tubular; tube ca. 10 mm; lobes oblong-ovate, ca. 2.5 mm. Berries subglobose, 3–4 × 4–5 mm, glabrescent. Fl. Jul–Aug, fr. Oct–Nov.

On rocks in ravines; 500–700 m. Guangxi (Longzhou) [N Vietnam].

**2. *Myrioneuron faberi*** Hemsley, J. Linn. Soc., Bot. 23: 380. 1888 [*“faberii”*].

密脉木 mi mai mu

*Myrioneuron oligoneuron* Handel-Mazzetti.

Large to suffruticose herbs, 0.2–1 m tall; branches densely puberulent, shortly pilosulous, or tomentulose. Leaves sometimes crowded at upper part of branches; petiole 0.7–1(–2) cm, densely puberulent to tomentulose; blade drying papery and grayish green, pale abaxially, obovate, elliptic, or oblong-obovate, (10–)12–23 × 4.5–10 cm, adaxially glabrous, abaxially densely puberulent to glabrescent on lamina and densely puberulent to tomentulose along veins, base acute to obtuse, apex cuspidate or acute; secondary veins 9–15 pairs; stipules lanceolate-oblong to ovate or narrowly triangular, 6.5–15 mm, glabrous to densely puberulent, densely parallel-veined to palmately veined, acute to shortly bilobed. Inflorescences terminal, globose; peduncle 3–10 mm; branched portion subcapitate to congested-cymose, subglobose, 2–3.5 cm; bracts ovate to lanceolate or obovate, 8–20 mm, densely puberulent, densely parallel-veined to palmately veined, acute to acuminate. Flowers subsessile. Calyx puberulent to glabrous; hypanthium portion subglobose to obconic, 1.5–2 mm; limb divided to base; lobes

narrowly triangular to linear, 6–12 mm, densely longitudinally veined. Corolla yellow, tubular, outside puberulent to glabrous; tube 9–10 mm; lobes triangular to ovate, 1.5–2 mm. Berries subglobose, ca. 3.5 mm in diam., glabrous to puberulent, with pedicels often elongating, to 8 mm. Fl. Aug, fr. Oct–Dec.

• Forests, often by streams; 500–1500 m. Guangxi, Guizhou, Hubei, Hunan, Sichuan, Yunnan.

This name was originally published as *“faberii”* and has been cited thus by several authors; however, current guidelines for orthography require correction to the form used here.

**3. *Myrioneuron nutans*** Wallich ex Kurz, Forest Fl. Burma 2: 55. 1877.

垂花密脉木 chui hua mi mai mu

Small shrubs, ca. 1 m tall. Petiole 0.5–2 cm; leaf blade drying leathery and green, broadly elliptic or obovate, 10–25(–35) × 6–14(–18) cm, adaxially glabrous, abaxially puberulent at least on veins, base acute to attenuate, apex abruptly acuminate; secondary veins 11–20 pairs; stipules triangular-lanceolate, 10–20 mm. Inflorescences terminal or pseudoaxillary, globose, 2.5–6 cm in diam., congested-cymose or rarely laxly cymose; peduncle short; bracts ovate or lanceolate, 8–15 mm, acuminate. Calyx glabrous to scabridulous; limb lobed to base; lobes linear-lanceolate, 10–12 mm. Corolla white or yellow, tubular, outside puberulent; tube 5–6 mm; lobes ovate, ca. 1.8 mm. Berries fleshy to dry, 4–7 mm in diam., glabrescent. Fl. Mar.

Forests; ca. 700 m [to only ca. 300 m in Bhutan]. Xizang (Mé-dog), Yunnan (Mengzi) [Bangladesh, Bhutan, N India].

**4. *Myrioneuron tonkinense*** Pitard in Lecomte, Fl. Indo-Chine 3: 193. 1923.

越南密脉木 yue nan mi mai mu

Herbs, sometimes suffruticose, to 1(–2) m tall; branches densely puberulent, papillose, or tomentulose. Petiole 0.8–3 cm, densely puberulent to tomentulose; leaf blade drying papery and grayish green, obovate, elliptic-oblong, or elliptic, 12–28 × 4–11 cm, adaxially glabrous, abaxially densely puberulent, base acute to cuneate, apex acute or rounded then abruptly acuminate; secondary veins 9–18 pairs; stipules ovate to oblong, 12–25 mm, densely puberulent, densely striate veined, acute or shortly 2-lobed. Inflorescences terminal and/or usually pseudoaxillary, subsessile, congested-cymose to subcapitate to shortly racemiform, subglobose to ovoid, 1–3 cm; bracts ovate or ovate-lanceolate, 10–25 mm, densely puberulent, densely longitudinally veined, acute to acuminate. Flowers subsessile or with pedicels to 3 mm. Calyx densely puberulent; hypanthium portion subglobose to ovoid, ca. 2 mm; limb divided to base; lobes linear-subulate, 6–14 mm. Corolla yellow, tubular; tube 7.5–8

mm; lobes 2.5–3 mm. Berries subglobose, 3–4 mm in diam. Fl. Jun–Aug, fr. Oct–Dec.

Dense forests; below 100–1700 m. Guangdong, Guangxi, Hainan, Yunnan [N Vietnam].

H. S. Lo (in FRPS 71(1): 312. 1999) recognized two forms of this species: “*f. tonkinensis*” [sic!] and “*f. longipes* Lo.” However, Lo failed to provide the latter name with a Latin description or diagnosis (*Vienna Code*, Art. 36.1) and an indication of a type (Art. 37.1); therefore, neither name was validly published.

## 59. NAUCLEA Linnaeus, Sp. Pl., ed. 2, 1: 243. 1762.

乌檀属 *wu tan shu*

Chen Tao (陈涛); Charlotte M. Taylor

*Bancales* Kuntze.

Trees, unarmed; buds strongly compressed with stipules erect and pressed together [rarely subconical]. Raphides absent. Leaves opposite, usually with domatia; stipules caducous or persistent, interpetiolar, generally elliptic or obovate. Inflorescences terminal and sometimes also axillary, capitate with heads 1–5, globose, and solitary to fasciculate, many flowered, pedunculate, bracteate; peduncles articulate and often bracteate near middle. Flowers sessile, fused by their ovaries, bisexual, monomorphic. Calyx limb 4- or 5-lobed. Corolla white to yellow, funnellform to salverform, inside glabrous; lobes 4 or 5, imbricate in bud. Stamens 4 or 5, inserted in upper part of corolla tube, exerted; filaments short; anthers basifixed. Ovary 2-celled, ovules numerous in each cell, pendulous to horizontal on Y-shaped axile placentas attached to upper third of septum; stigma fusiform, exerted. Infructescences with fruiting heads each comprising a globose multiple fruit (i.e., syncarp). Fruit (i.e., fruitlets, arising from one flower) baccate, fleshy or fibrous, with calyx limb deciduous; seeds numerous, small, ovoid or ellipsoid, sometimes slightly compressed, without aril.

About ten species: tropical Africa, Asia, and Australia; one species in China.

The wood of several *Nauclea* species is strong and used for lumber.

The S Asian species *Nauclea orientalis* (Linnaeus) Linnaeus is occasionally cultivated; this can be recognized by its elliptic-oblong leaves 6–12 cm wide, its flowering heads 15–20 mm in diam. across the calyces, and its fruiting heads to 5 cm in diam. Both *N. officinalis* and *N. orientalis* species are encountered and occasionally confused in cultivation with the more commonly cultivated *Neolamarckia cadamba*, which has free (i.e., distinct or separate) flowers and free dehiscent fruit (see p. 255).

**1. *Nauclea officinalis*** (Pierre ex Pitard) Merrill & Chun, Sunyatsenia 5: 188. 1940.

乌檀 *wu tan*

*Sarcocephalus officinalis* Pierre ex Pitard in Lecomte, Fl. Indo-Chine 3: 26. 1922.

Trees, apparently evergreen, to 12 m tall; branchlets angled and rather flattened becoming terete, puberulent to glabrescent. Petiole 10–15[–20] mm; leaf blade drying papery, elliptic to broadly elliptic or infrequently ovate or obovate, 7–11[–15] × 3.5–7[–10] cm, glabrous, adaxially dark brown and matte to shiny, abaxially pale brown and matte, base cuneate to obtuse, apex shortly acuminate with tip slightly blunt; secondary veins 5–7 pairs, usually with tiny foveolate domatia in abaxial axils; stipules caducous, obovate to elliptic, 6–10 mm,

glabrous, smooth, rounded. Inflorescences terminal, puberulent to glabrous; peduncles 1–3.5[–4.5] cm, in lower part articulate, bearing caducous bracts 2–4 mm; flowering heads 1–3, 5–6 mm in diam. across calyces, ca. 15 mm in diam. across corollas. Calyx limb deeply lobed; lobes 5, oblanceolate to spatulate, ca. 1 mm, glabrescent, fleshy, rounded to subtruncate. Corolla color unknown, narrowly funnellform, glabrous outside and apparently inside; tube 3–4 mm; lobes 5, ligulate to elliptic, 1–1.5 mm, obtuse to rounded. Stigmas 1.5–2 mm, exerted for ca. 3 mm. Fruiting heads (i.e., multiple fruit) yellow, 9–15 mm in diam., fleshy, with surface rough (i.e., pitted with calyx limb scars); seeds ca. 1 mm, with testa shiny black, foveolate. Fl. summer, fr. Jul, Sep.

Forests at middle elevations. Guangdong, Guangxi, Hainan [Borneo, Cambodia, Indonesia (Sumatra), Laos, Malaysia, ?Philippines, Thailand, Vietnam].

## 60. NEANOTIS W. H. Lewis, Ann. Missouri Bot. Gard. 53: 34. 1966.

新耳草属 *xin er cao shu*

Chen Tao (陈涛); Charlotte M. Taylor

Herbs, annual or perennial, unarmed, often procumbent, often fetid when bruised, often fleshy, often drying blackened. Raphides present. Leaves opposite, without domatia; stipules persistent, interpetiolar and usually fused to petioles, truncate to triangular, lacinate to setose, sometimes glandular. Inflorescences axillary and/or terminal and sometimes displaced to pseudoaxillary, laxly cymose to capitate, few to many flowered, pedunculate to sessile, bracteate or bracts reduced. Flowers sessile to pedicellate, bisexual, at least sometimes distylous. Calyx limb deeply 4(or 5)-lobed. Corolla white, pink, or purple, funnellform to tubular, inside glabrous or villous in tube and/or throat; lobes 4(or 5), valvate in bud. Stamens 4(or 5), inserted usually in corolla throat, exerted or included; filaments short to developed; anthers dorsifixed near base. Ovary 2[–4]-celled, ovules several or rarely numerous or 1 in each cell on ascending axile placenta attached to septum near base; stigmas 2(–4), linear, included or exerted. Fruit capsular or rarely

indehiscent, subglobose, turbinate, obconic, ovoid, or dicocous, often laterally compressed, loculicidally dehiscent through apical portion, this portion plane or sometimes shortly raised into a beak, leathery to membranous, with calyx limb persistent; seeds few to numerous, small, disciform to plano-convex, rounded or rarely winged, scabrous foveolate; endosperm corneous; embryo clavate.

About 30 species: mainly in tropical Asia and Australia; eight species (two endemic) in China.

When proposing this generic name, Lewis showed that *Anotis* Candolle, as then circumscribed, included a broadly heterogeneous group of both New and Old World species that shared only a herbaceous habit and fruit with few peltate seeds under an illegitimate name. Accordingly he transferred the Asian species to *Neanotis*, without descriptions or keys, although this name has sometimes been overlooked. The fruit and seed morphology of several species was studied by Terrell and Robinson (J. Bot. Res. Inst. Texas 1(1): 373–384. 2007), including *N. calycina* and *N. hirsuta* of our flora. The description here of the placenta attachment position and the seeds of other species are all from W. C. Ko (in FRPS 71(1): 77–86. 1999); no other authors seen have described these features. The floral biology of *Neanotis* has not been described in the literature but the flowers appear to be distylous in at least some Chinese species.

The treatment here differs from that of W. C. Ko (loc. cit.) in the circumscription of several species. In particular, the application of the name *Neanotis hirsuta* is applied more narrowly, and many specimens previously included there are here treated as *N. kwangtungensis*, including one variety named in *N. hirsuta*.

Some plants from Sichuan that are shorter than 40 cm tall with leaf blades narrowly ovate and  $1.5\text{--}2.5 \times 0.7\text{--}1$  cm have been called *Neanotis ingrata* f. *parvifolia* How ex W. C. Ko (J. S. China Agric. Univ. 16(4): 46. 1995); no specimens of this have been seen, and no more information was provided in the protologue. Due to the limited available information and the narrowed circumscription of species here, the identity of this name is not clear, and it is neither accepted nor synonymized here.

- 1a. Inflorescences axillary at various nodes all below stem apex, flowers solitary to few, subsessile to shortly fasciculate; at least older stems prostrate and regularly rooting at nodes ..... 1. *N. boerhaavioides*
- 1b. Inflorescences terminal and/or axillary at least at some uppermost nodes, flowers solitary to numerous, sessile to pedicellate and/or pedunculate; stems prostrate and rooting at nodes to erect.
- 2a. At least some flowers and fruit pedicellate with pedicels 2–10 mm.
- 3a. Flowers mixed pedicellate and subsessile, with pedicels of various lengths; corollas tubular, with tube longer than lobes, tube ca. 2 mm and lobes ca. 1 mm ..... 2. *N. calycina*
- 3b. Flowers all pedicellate, with most pedicels well developed; corollas campanulate to rotate, with tube shorter than lobes, tube 1–1.5 mm and lobes 2.5–3.5 mm ..... 7. *N. thwaitesiana*
- 2b. Flowers and fruit subsessile to sessile in small glomerules or mixed sessile and pedicellate, glomerules sometimes separated by developed inflorescence axes, pedicels when present to 1.5 mm.
- 4a. Plants mostly procumbent; inflorescences capitate or branched to 1 order, sessile or on peduncles to 1 cm, flowers in heads or congested cymes; corolla with tube 1–2.5 mm and lobes 0.2–2 mm.
- 5a. Leaves  $1\text{--}6.5 \times 0.5\text{--}2$  cm, with 3–9 pairs of secondary veins; corolla with tube 1–1.5 mm and lobes 1.5–2 mm; fruit ca.  $3 \times 4$  mm ..... 6. *N. kwangtungensis*
- 5b. Leaves  $0.5\text{--}2.5 \times 0.3\text{--}1.8$  cm, with 2 or 3 pairs of secondary veins; corolla with tube 1.3–2.5 mm and lobes 0.2–1.5 mm; fruit  $1.5\text{--}2 \times 1.5\text{--}2.5$  mm ..... 8. *N. wightiana*
- 4b. Plants weak to procumbent or erect; inflorescences congested to laxly cymose, branched for 2–4 orders, on peduncles 0.8–4.5 cm, flowers pedicellate or sessile in heads or glomerules; corolla with tube 3.5–6 mm and lobes 2.2–3.2 mm.
- 6a. Leaves  $4\text{--}11.5 \times 1\text{--}4$  cm; stipules with setae or lobes 3 to numerous per side, 3–15 mm with at least 1 of them longer than 5 mm; corolla tube 4–6 mm ..... 5. *N. ingrata*
- 6b. Leaves  $1\text{--}5.5 \times 1\text{--}4$  cm; stipules with setae or lobes 3–7 per side, 0.5–5 mm; corolla tube 3.5–5.5 mm.
- 7a. Flowers some or all pedicellate, pedicels 0.5–1.5 mm; Taiwan ..... 3. *N. formosana*
- 7b. Flowers all sessile; widespread ..... 4. *N. hirsuta*

**1. *Neanotis boerhaavioides*** (Hance) W. H. Lewis, Ann. Missouri Bot. Gard. 53: 37. 1966.

卷毛新耳草 juan mao xin er cao

*Hedyotis boerhaavioides* Hance, J. Bot. 8: 73. 1870;  
*Anotis boerhaavioides* (Hance) Maximowicz.

Herbs, annual or perhaps perennial, procumbent, fleshy, regularly rooting at nodes; stems subterete to 4-angled and sulcate, moderately to densely pilosulous to hirtellous and/or hirsute in lines. Leaves subsessile or petiolate; petiole to 3 mm, pilosulous or hirtellous to glabrous; blade drying papery, ovate, lanceolate, ovate-orbicular, or lanceolate-elliptic,  $1\text{--}2 \times 0.4\text{--}1.5$

cm, adaxially hirtellous, pilosulous, and/or hispidulous near margins, abaxially hirtellous to pilosulous, base cuneate to rounded or truncate, apex obtuse to acute; secondary veins 2 or 3 pairs; stipules triangular to rounded, 1–3 mm, hirtellous or pilosulous, lobe or bristle 1, 2–2.5 mm, ciliate, sometimes with 2 lateral bristles to 1.5 mm. Inflorescences axillary at middle and lower stem nodes, fasciculate, (1 or) 2–5-flowered, hirtellous; bracts linear, 0.5–2 mm; peduncles 0.5–3.5 mm. Calyx moderately to densely pilosulous to hirtellous; hypanthium portion subglobose to obconic, 0.8–1 mm; limb divided essentially to base; lobes 4, narrowly triangular, 1.6–3 mm, ciliolate, acute. Corolla white to pale blue, shortly funnelliform, outside glabrous; tube 2–3 mm, apparently pilose in throat; lobes narrowly

ligulate to narrowly triangular, 3–4 mm. Capsule compressed globose to subglobose, 1.5–2 mm, hirtellous, smooth to weakly ridged. Fl. Apr–Aug, fr. Jul–Aug.

• Sparse forests on mountain slopes at middle elevations; 100–600 m. Fujian, Guangdong, Jiangxi, Zhejiang.

This species appears to be distylous (long-styled, *Zhang Shaoyao 5681*, short-styled *Zhang Shaoyao 2416*, both MO!). It is very similar to *Hedyotis chrysotricha*, which has calyx lobes ca. 2 mm and the corolla lobes 2.5–3 mm.

**2. *Neanotis calycina*** (Wallich ex J. D. Hooker) W. H. Lewis, Ann. Missouri Bot. Gard. 53: 37. 1966.

紫花新耳草 *zi hua xin er cao*

*Anotis calycina* Wallich ex J. D. Hooker, Fl. Brit. India 3: 73. 1880.

Herbs, erect to ascending, annual or perhaps perennial; stems 4-angled to subterete or sulcate, glabrous or sparsely puberulent. Leaves subsessile or petiolate; petiole to 3 mm, glabrous; blade drying papery, lanceolate to ovate-lanceolate or lanceolate-elliptic, 1–3.5 × 0.5–1.5 cm, adaxially sparsely scaberulous to puberulent, abaxially glabrous or puberulent to scaberulous on principal veins, base cuneate to acute, margins ciliate to scaberulous, apex acute to acuminate; secondary veins 3 or 4 pairs; stipules broadly triangular, 1–3 mm, glabrescent, subentire or with 1 or 3 bristles to 1 mm, entire or ciliate. Inflorescences axillary and/or terminal, 1-flowered or cymose, several flowered, and dichotomous, glabrous; peduncles 0.5–2.5 cm; pedicels to 7 mm. Flowers sessile to pedicellate. Calyx glabrous; hypanthium portion obconic, ca. 0.8 mm; limb divided essentially to base; lobes triangular, 0.5–1.3 mm, entire to ciliate, acute. Corolla white, pale pink, or pale purple, tubular to tubular-funnelform, outside glabrous; tube 1.5–2 mm, apparently glabrous in throat; lobes triangular to lanceolate, 0.5–1 mm, obtuse to acute. Capsule compressed globose, 1.5–2 × ca. 3 mm, glabrous. Fl. Sep–Oct.

Streamsides, slightly shady mountain slopes, valleys; 1100–1700 m. Yunnan [Bhutan, India (Darjeeling), Nepal].

R. R. Mill in Fl. Bhutan 2(2): 770. 1999 described this as annual, but it is keyed there (p. 767) as a perennial.

**3. *Neanotis formosana*** (Hayata) W. H. Lewis, Ann. Missouri Bot. Gard. 53: 38. 1966.

台湾新耳草 *tai wan xin er cao*

*Anotis formosana* Hayata, Icon. Pl. Formosan. 9: 54. 1920.

Herbs, perhaps perennial, stems decumbent near base and ascending in upper parts, to 30 cm; stems terete to angled and sometimes sulcate, glabrous. Leaves subsessile or petiolate; petiole to 3 mm, sparsely hirtellous to glabrous; blade drying papery or membranous, ovate, ovate-oblong, or lanceolate, 1–3 × 0.5–1.6 cm, adaxially sparsely to moderately hirtellous, scaberulous, or hispid, abaxially glabrous or sparsely to moderately hirtellous along principal veins, base obtuse to subrounded, apex acute; secondary veins 3 or 4 pairs; stipules triangular, 1–2 mm, hirtellous, erose to pectinate or with 3–5 bristles or lobes 1–5 mm, sometimes glandular. Inflorescences terminal or rarely

pseudoaxillary, cymose, lax with flowers in groups of 2–5, branched to 2 or 3 orders, glabrous; peduncle 0.8–2.5 cm; bracts lacinate or stipuliform, 0.5–2 mm; pedicels 0.5–1.5 mm. Calyx glabrous; hypanthium portion subcupuliform to obconic; limb divided to base; lobes triangular, 1.5–2 mm, acute. Corolla white, funnelform, outside glabrous; tube 4–5.5 mm, puberulent-papillose to perhaps pubescent inside; lobes triangular, 3–3.2 mm. Capsule compressed globose, 2–2.5 × 3–3.5 mm, glabrous. Fl. Apr–Jul, fr. Jun–Jul.

Mountain slopes, roadsides; 1100–1700 m. Taiwan [Japan, Malaysia].

**4. *Neanotis hirsuta*** (Linnaeus f.) W. H. Lewis, Ann. Missouri Bot. Gard. 53: 38. 1966.

薄叶新耳草 *bao ye xin er cao*

*Oldenlandia hirsuta* Linnaeus f., Suppl. Pl. 127. 1782; *Anotis hirsuta* (Linnaeus f.) Boerlage; *Hedyotis hirsuta* (Linnaeus f.) Smith (1811), not Lamarck (1789); *H. stipulata* R. Brown ex J. D. Hooker, nom. illeg. superfl.; *O. japonica* Miquel.

Herbs, perennial, lower stems decumbent and upper stems apparently ascending; stems terete to 4-angled, glabrous to hirtellous in lines or throughout, angles sometimes thickened. Leaves petiolate; petiole 1–5 mm, glabrous to hirtellous or hispid; blade drying papery, ovate, lanceolate, or elliptic, 1–5.5 × 0.5–2 cm, adaxially glabrous or sparsely to moderately strigillose, scaberulous, or hirtellous, abaxially densely hirtellous or glabrous except sparsely strigillose or puberulent on principal veins, base rounded to cuneate, apex acute; secondary veins 3–5 pairs; stipules rounded to triangular, 1–2 mm, glabrous to hirtellous, lacinate to setose, lobes or bristles 3–7, 0.5–5 mm, glabrous to ciliate. Inflorescences terminal and/or pseudoaxillary, laxly cymose, branched to 2 or 3 orders often asymmetrically, with flowers borne separately or in glomerules of 2–5, glabrous or hirtellous; peduncle 0.8–3 cm; bracts lacinate or stipuliform, 0.5–2 mm. Flowers sessile or subsessile, floral biology unknown. Calyx glabrous to densely hirtellous; hypanthium portion obconic, ca. 1 mm; limb divided essentially to base; lobes linear-lanceolate, 1–2 mm. Corolla white, funnelform, outside glabrous; tube 3.5–4 mm, puberulent or perhaps pubescent inside; lobes ovate to triangular, 2.2–3 mm. Capsule compressed globose, 2–2.5 × 2.5–3 mm, glabrous to hirtellous. Fl. and fr. Jun–Oct.

Wet sites at streamsides or in forests; 500–1000(–1500) m. Guangdong, Hainan, Jiangsu, Jiangxi, Taiwan, Yunnan, Zhejiang [?Bhutan, Cambodia, India, Japan, Korea, Laos, Myanmar, Nepal, Pakistan, Thailand, Vietnam].

The application of this name is problematic, and it seems to have been used in the literature and the herbarium for different species in different regions (e.g., cf. Fl. Bhutan 2(2): 768. 1999; Fl. Japan 3a: 218–219. 1993). The confusion probably started with Hooker's circumscription of this species (Fl. Brit. India 3: 63. 1880), which included three other names in synonymy to circumscribe morphologically highly varied group of plants from India through Java and Japan. Here *Neanotis hirsuta* is circumscribed more narrowly. The varieties of *N. hirsuta* recognized by W. C. Ko (in FRPS 71(1): 84–85. 1999) are not completely distinct morphologically and fall within *N. kwangtungensis* as circumscribed here.

**5. *Neanotis ingrata*** (Wallich ex J. D. Hooker) W. H. Lewis, *Ann. Missouri Bot. Gard.* 53: 39. 1966.

臭味新耳草 *chou wei xin er cao*

*Anotis ingrata* Wallich ex J. D. Hooker, *Fl. Brit. India* 3: 71. 1880.

Herbs, perennial, erect to procumbent, to 1 m tall; stems terete to flattened or ridged, often sulcate, glabrous or sometimes sparsely hirtellous to puberulent near nodes. Leaves sessile or petiolate; petiole to 12 mm; blade drying papery, lanceolate, elliptic, ovate-lanceolate, or rarely ovate, 4–11.5 × 1–4 cm, adaxially glabrous or sparsely to moderately strigillose, pilosulous, pilose, or hispid, abaxially glabrous except usually densely puberulent, hirtellous, or pilosulous on principal veins, base obtuse to acute, apex acute to acuminate; secondary veins 4–9 pairs; stipules rounded to broadly triangular, 1–2.5 mm, puberulent, hirtellous, or glabrescent, with 3 to numerous setae or linear lobes 3–15 mm, glabrous to ciliate, often inserted below top of sheath. Inflorescences terminal, subterminal, or pseudoaxillary, cymose, lax, dichasial with axes often asymmetrical, branched to 2–4 orders, glabrous; peduncle 1–4.5 cm; bracts stipuliform to reduced and erose or ciliate, 0.2–1.5 mm; pedicels to 0.5 mm. Calyx glabrous; hypanthium portion obconic, 0.8–1 mm; limb divided to base; lobes narrowly triangular, linear, or narrowly ligulate, 1.2–2 mm, entire to ciliate. Corolla white, funnellform, outside glabrous; tube 4–6 mm, apparently pubescent inside; lobes narrowly triangular to ligulate, 2.5–3 mm, often puberulent adaxially. Capsule compressed globose, ca. 2 × 3 mm, slightly dicocous, glabrous, with calyx lobes often elongating, to 4 mm, with pedicels sometimes elongating, to 2 mm. Fl. Jun–Sep, fr. Jul.

Grassy slopes on riverbanks, forests on mountain slopes; 500–1500 m. Fujian, Guizhou, Hubei, Hunan, Jiangsu, Sichuan, Xizang, Yunnan, Zhejiang [Bhutan, India, Nepal].

Several specimens from Sichuan have been suggested (in herb.) to belong to *Neanotis urophylla* (Wallich ex Wight & Arnott) W. H. Lewis (*Ann. Missouri Bot. Gard.* 53: 40. 1966; *Hedyotis urophylla* Wallich ex Wight & Arnott, *Prodr. Fl. Ind. Orient.* 404. 1834), but they are provisionally included here pending further study, including clarification of the identity of *N. urophylla* (*W. P. Fang* 2148, 2182, 3061, all P!).

The identity of the name *Neanotis mairei* (H. Léveillé) Lauener & D. K. Ferguson (*Notes Roy. Bot. Gard. Edinburgh* 32: 110. 1972; *Ophiorrhiza mairei* H. Léveillé, *Repert. Spec. Nov. Regni Veg.* 13: 177. 1914, from Yunnan) is not entirely clear. This name was found to belong to *Neanotis* after Lewis's work and was said by Lauener to be similar to *N. urophylla* and *N. ingrata*. The characters used by Lauener to distinguish *N. mairei* from *N. ingrata* fall within the circumscription of *N. ingrata* here, so this name is probably a synonym; however, until authentic material is seen this cannot be conclusively synonymized.

**6. *Neanotis kwangtungensis*** (Merrill & F. P. Metcalf) W. H. Lewis, *Ann. Missouri Bot. Gard.* 53: 39. 1966.

广东新耳草 *guang dong xin er cao*

*Anotis kwangtungensis* Merrill & F. P. Metcalf, *Lingnan Sci. J.* 16: 177. 1937; *Hedyotis lindleyana* Hooker ex Wight & Arnott f. *glabricalycina* (Honda) S. S. Ying; *H. lindleyana* var.

*glabricalycina* (Honda) H. Hara; *Neanotis hirsuta* (Linnaeus f.) W. H. Lewis var. *glabricalycina* (Honda) W. H. Lewis; *Oldenlandia hirsuta* Linnaeus f. var. *glabricalycina* Honda.

Herbs, perhaps perennial, procumbent or ascending in upper parts; stems subterete to angled or compressed, smooth to ridged and/or sulcate, glabrous. Leaves subsessile or petiolate; petiole to 10 mm, glabrous; blade elliptic, lanceolate, or ovate, 1–5 × 0.5–2 cm, glabrous or sparsely strigillose or scaberulous adaxially at least near margins, abaxially glabrous or sometimes puberulent on principal veins, base acute to obtuse, apex acuminate to acute; secondary veins 3–9 pairs; stipules sheath rounded to broadly triangular, 0.8–1.5 mm, glabrous to puberulent, with 2–7 bristles or linear lobes 0.3–3 mm, glabrous, often glandular. Inflorescences terminal and/or pseudoaxillary at upper nodes on principal and short axillary stems, capitate to congested-cymose, 1 to usually several flowered, glabrous, sessile or peduncle to 3 mm; bracts reduced, stipuliform, to 0.5 mm; pedicels to 2 mm. Flowers subsessile to pedicellate. Calyx glabrous; hypanthium portion cupuliform to turbinate, 0.8–1.2 mm; limb lobed to base; lobes triangular or ligulate, 1.5–2.5 mm. Corolla white, shortly tubular to rotate, outside glabrous or puberulent; tube 1–1.5 mm, apparently glabrous in throat; lobes narrowly triangular-oblong to ligulate, 1.5–2 mm. Capsule compressed subglobose to obovoid, ca. 3 × 4 mm, slightly dicocous, glabrous, smooth. Fl. and fr. Jul–Oct.

Forests on gentle slopes or at streamsides; 200–800 m. Guangdong, Guangxi, Jiangxi, Sichuan, Taiwan [Japan, Thailand].

This name is applied here more broadly than by previous authors; many of the plants that now belong to this species were formerly included in a more broadly circumscribed *Neanotis hirsuta*. The varieties of *N. hirsuta* recognized by W. C. Ko (in *FRPS* 71(1): 84–85. 1999) are not completely distinct from each other and belong to *N. kwangtungensis* as circumscribed here. The name *Hedyotis lindleyana* as used for specimens from Japan appears to be a synonym of *N. kwangtungensis* rather than of *N. hirsuta*, and the range of this species is here extended to include Japan; *N. kwangtungensis* as treated here is apparently equivalent to "*N. hirsuta*" of the *Fl. Japan* (3a: 218–219. 1993). The name "*Hedyotis kwangtungensis* (Merrill & Metcalf) Ko" is annotated on some specimens but does not appear to have been published.

**7. *Neanotis thwaitesiana*** (Hance) W. H. Lewis, *Ann. Missouri Bot. Gard.* 53: 40. 1966.

新耳草 *xin er cao*

*Hedyotis thwaitesiana* Hance, *J. Bot.* 6: 298. 1868; *Anotis thwaitesiana* (Hance) Maximowicz.

Herbs, apparently perennial, weak to procumbent in lower parts and ascending in upper parts of stems; stems terete to 4-angled with angles often thickened, glabrous. Leaves sessile or petiolate; petiole to 1.5 mm, puberulent to glabrous; blade drying papery, ovate or ovate-lanceolate, 0.8–2.2 × 0.3–1.5 cm, adaxially puberulent or scaberulous at least on midrib and margins, abaxially glabrous, base cuneate to rounded, apex obtuse to acute; secondary veins 2 or 3 pairs or not evident; stipules triangular to ligulate, 1–2 mm, puberulent to hirtellous or glabrous, erose or with 1–3 irregular lobes or bristles 0.5–3.5 mm, often glandular. Inflorescences pseudoaxillary at upper stem nodes and/or occasionally terminal, laxly cymose, several flow-

ered, branched to 1–3 orders, glabrous; peduncles slender, 1.5–3 cm; bracts linear-lanceolate or stipuliform, 1–3 mm; pedicels slender, 2–10 mm. Calyx glabrous; hypanthium portion cupular to obconic, ca. 1 mm; limb lobed to base; lobes triangular, 1.2–2 mm, entire. Corolla white or pale red, campanulate to rotate, outside glabrous; tube 1–1.5 mm, apparently pilosulous in throat; lobes ligulate to narrowly triangular, 2.5–3.5 mm. Capsules compressed globose to compressed turbinate, ca.  $2 \times 3$  mm, glabrous. Fl. Feb–May, fr. May.

- Wastelands or streamsides in valleys. Guangdong.

This species is clearly distylous. W. C. Ko (in FRPS 71(1): 82. 1999) described the corollas as soft hairy outside, but these features have not been seen on the specimens studied.

**8. *Neanotis wightiana*** (Wallich ex Wight & Arnott) W. H. Lewis, Ann. Missouri Bot. Gard. 53: 40. 1966.

西南新耳草 xi nan xin er cao

*Hedyotis wightiana* Wallich ex Wight & Arnott, Prodr. Fl. Ind. Orient. 1: 410. 1834; *Anotis wightiana* (Wallich ex Wight & Arnott) J. D. Hooker.

Herbs, perennial, mostly procumbent and rooting at nodes; stems angled to subterete, sometimes sulcate, glabrous to hirtellous or hirsute at least near nodes. Leaves sessile or petiolate; petiole to 4 mm, hirtellous to glabrescent; blade drying papery to subleathery, ovate to lanceolate,  $0.5\text{--}1.8\text{--}(2.5) \times 0.3\text{--}1.2$

(–1.8) cm, adaxially sparsely to moderately puberulent, scaberrulous, or scabrous at least on midrib and margins, abaxially glabrous except hirtellous on midrib and sometimes principal veins, base broadly cuneate to subrounded, apex acute to obtuse; secondary veins 2 or 3 pairs; stipules rounded to triangular, ca. 1 mm, hirtellous or pilosulous, erose to pectinate or with 1–7 bristles or linear lobes 0.2–2 mm, often glandular. Inflorescences capitate to congested-cymose, terminal or pseudoaxillary at upper nodes on principal stems and short lateral stems, several flowered, sessile or with peduncle to 1 cm; bracts reduced. Flowers sessile or subsessile. Calyx glabrous to puberulent; hypanthium portion obconic to turbinate, ca. 1 mm; limb divided to base; lobes triangular, 1–1.5 mm, entire to ciliate. Corolla white or rarely pale red, tubular to tubular-funnelform, outside glabrous; tube 1.3–2.5 mm, inside glabrous; lobes 0.2–1.5 mm, obtuse to acute. Capsule compressed globose,  $1.5\text{--}2 \times 1.5\text{--}2.5$  mm, often markedly dicoccos, glabrous, smooth. Fl. May–Jul, fr. Jun–Oct.

Grassy slopes, roadsides, banks at streamsides; 900–1900 m. Guangxi (Damao Shan), Guizhou, Sichuan, Yunnan (Pingbian) [Bhutan, India, Vietnam].

The inflorescences were described by W. C. Ko (in FRPS 71(1): 84. 1999) as usually having two leaflike bracts, but here these structures are considered leaves subtending the inflorescence, similarly to the morphological interpretation by Mill (Fl. Bhutan 2(2): 770–771. 1999); these leaves are small when the flowers form but enlarge to the size of the other vegetative leaves as the fruit develop.

## 61. *NEOHYMENOPOGON* Bennet, Indian Forester 107: 436. 1981.

石丁香属 shi ding xiang shu

Chen Tao (陈涛); Charlotte M. Taylor

*Hymenopogon* Wallich in Roxburgh, Fl. Ind. 2: 156. 1824, not *Hymenopogon* P. Beauvois (1804) [Musci].

Shrubs, usually epiphytic, unarmed, often deciduous, often rather succulent. Raphides presumably absent. Leaves opposite, apparently without domatia; stipules persistent, interpetiolar or shortly united around stem, generally ovate, acute to rounded. Inflorescences terminal, corymbose-cymose, many flowered, pedunculate, bracteate; bracts subtending 2 or more cymes per inflorescence enlarged, petaloid, stipitate (i.e., similar to a calycophyll). Flowers pedicellate, bisexual, monomorphic. Calyx limb 5-lobed. Corolla white to pale green, salverform or salverform-funnelform with tube prolonged, inside reflexed villous in throat and on lobes; lobes 5, valvate in bud. Stamens 5, inserted below corolla throat, included; filaments short; anthers dorsifixed, shortly bifid at base. Ovary 2-celled, ovules numerous in each cell on peltate axile placentas; stigmas 2, linear, partially exerted to included. Fruit capsular, oblong-ellipsoid, obovoid, or turbinate, apically prolonged into short beak, septically dehiscent through beak or sometimes splitting deeply into 2 valves, papery to slightly woody, with calyx limb persistent; seeds numerous, medium-sized, fusiform, acute to caudate at each end, with hilum lateral; testa membranous; endosperm rich; embryo minute; cotyledon ovate; radicle short.

About three species: Bhutan, China, India, Myanmar, Nepal, Thailand, Vietnam; two species (one endemic) in China.

The lack of raphides has not been specifically noted but is presumed here based on the classification of this genus in Cinchoneae in FRPS (71(1): x. 1999). The enlarged petaloid bracts of the inflorescences resemble the calycophylls of many other Rubiaceae species, but in *Neohymenopogon* many of these structures are inserted below the base of the hypanthium and are thus actually considered bracts. Puff et al. (Rubiaceae of Thailand, 172. 2005) noted that *N. parasiticus* grows in a variety of seasonal to evergreen epiphytic and epilithic [micro]habitats, that, not surprisingly, it is very variable morphologically, probably in correlation with habitat, and that the petaloid bracts persist on the fruit and appear to function in seed dispersal as well as in pollination. The length of the corollas of *N. parasiticus* for example is notably variable, by 300%, but there seems to be continuous variation and no clearly separable subgroups. Raizada and Bennet (Indian Forester 107: 432–437. 1981) noted that the name *Hymenopogon*, long used for these plants, was a later homonym of a moss genus and published a new name for the genus; their article contained no information about the plants apart from a summary of general geographic ranges, which were not entirely correct even then. The specific epithets of these species have sometimes been spelled as “*parasiticum*” and “*oligocarpum*,” but the “-us” ending is correct (*Vienna Code*, Art. 62.2(a)).

- 1a. Leaves elliptic-oblong, oblanceolate, or elliptic, with apex acuminate, with secondary lateral veins to 11 pairs and well separated, i.e., 8–16 mm apart at midrib; fruit pilosulous to glabrous ..... 1. *N. oligocarpus*

1b. Leaves elliptic-obovate, lanceolate, oblanceolate, or obovate, with apex obtuse to acute, with secondary veins

15–28 pairs and closely set, i.e., 5–11 mm apart at midrib; fruit villosulous to pilosulous or strigillose ..... 2. *N. parasiticus*

**1. *Neohymenopogon oligocarpus*** (H. L. Li) Bennet, Indian Forester 107: 436. 1981.

疏果石丁香 shu guo shi ding xiang

*Hymenopogon oligocarpus* H. L. Li, J. Arnold Arbor. 25: 316. 1944.

Shrubs, ca. 2 m tall; branches flattened to subterete, glabrous. Leaves often crowded at stem apices; petiole 0.6–3 cm, pilosulous to strigillose; blade drying membranous, green adaxially, often whitened abaxially, elliptic-oblong, oblanceolate, or elliptic, 10–21 × 3–6 cm, strigillose to pilosulous on both surfaces with pubescence denser on principal veins, base cuneate to obtuse, apex slightly to markedly acuminate; secondary veins 7–11 pairs; stipules ovate, 3–5 mm, perhaps strigillose. Inflorescences strigillose to pilosulous; peduncle 1–5 cm; branched portion ca. 2 × 3 cm (not including petaloid bracts); bracts triangular, ca. 2 mm, petaloid bracts with blade portion elliptic-oblong to lanceolate, 2–3 × 0.5–1 cm, strigillose to pilosulous, with 3 principal veins, with stipe 1–3 cm; pedicels 0.5–1 cm. Flowers unknown. Capsules ellipsoid, ca. 1 × 0.5 cm, glabrous to pilosulous, with persistent calyx lobes lanceolate, ca. 5 mm, acute; seeds black, ca. 6 mm. Fr. Aug.

- Forests on mountains; ca. 2400 m. W Yunnan.

The only description of the flowers was given by W. C. Chen (in FRPS 71(1): 233. 1999), who listed the corolla as green-white and gave the flowering period as Aug. Chen distinguished this species in part by its glabrous fruit, but the accompanying illustration (p. 232, t. 57, f. 4) shows pilosulous fruit, as added to the description here.

**2. *Neohymenopogon parasiticus*** (Wallich) Bennet, Indian Forester 107: 436. 1981.

石丁香 shi ding xiang

*Hymenopogon parasiticus* Wallich in Roxburgh, Fl. Ind. 2:

157. 1824; *H. parasiticus* var. *longiflorus* F. C. How ex W. C. Chen.

Small shrubs, 0.3–2 m tall; branches stout, villosulous to hirtellous sometimes becoming glabrescent with age. Leaves sometimes grouped at apex of shortened branches; petiole 0.4–2 cm, villosulous to hirsutulous; blade drying papery or membranous, often grayish black, elliptic-obovate, lanceolate, oblanceolate, or obovate, 5–25 × 1.5–11 cm, adaxially puberulent to hirtellous, strigillose, or glabrescent, abaxially strigillose to pilosulous at least on principal veins, base obtuse to acute, apex obtuse, acute, or rarely acuminate; secondary veins 15–28 pairs; stipules ovate to suborbicular, 6–12 mm, strigillose to glabrous, cuspidate or obtuse to rounded. Inflorescences tomentulose to villosulous or villous, sessile and 3- or 5-partite, 4–18 × 4–24 cm (including petaloid bracts); bracts stipuliform, ovate, 5–15 mm, acuminate to 2-lobed, petaloid bracts white to cream, with blade portion drying papery to stiffly papery, elliptic-oblong to elliptic, 3–10 × 1.5–3.3 cm, strigillose to pilosulous or glabrescent, obtuse to acute, with stipe 2.5–4 cm; pedicels 0.8–1.2 cm. Calyx densely villosulous to tomentulose; ovary portion obconic, ca. 3 mm; limb deeply lobed, strigillose to glabrous; lobes lanceolate to narrowly triangular, 6–10 mm, acute. Corolla white [to pale green in Thailand], outside crisped villosulous to strigillose or strigose; tube 25–60 mm; lobes ovate-oblong to ovate, 5–10 mm, acute to obtuse. Capsules ellipsoid-oblong to ellipsoid, smooth or longitudinally weakly ridged, 1.5–3 × 0.6–1 cm, villosulous to pilosulous or strigillose; seeds 5–6 mm. Fl. Jun–Aug, fr. Sep–Dec.

On trees or rocks in thickets or forests in valleys; 1200–2700 m. Xizang, Yunnan [Bhutan, N India, Myanmar, Nepal, Thailand, Vietnam].

*Hymenopogon parasiticus* var. *longiflorus* was originally distinguished by its corolla length (5–7 cm vs. 2.5–4 cm in var. *parasiticus*). W. C. Chen (in FRPS 71(1): 233. 1999) synonymized these with some commentary.

## 62. NEOLAMARCKIA Bosser, Bull. Mus. Natl. Hist. Nat., B, Adansonia 6: 247. 1985.

团花属 tuan hua shu

Chen Tao (陈涛); Charlotte M. Taylor

Trees, unarmed; buds conical. Raphides absent. Leaves opposite, usually with domatia; stipules caducous, interpetiolar, triangular. Inflorescences terminal, capitate with heads globose and solitary, many flowered, pedunculate, bracteate. Flowers sessile, bisexual, monomorphic. Calyx limb 5-lobed; lobes sometime spatulate. Corolla yellow to white, salverform to funnellform, glabrous inside; lobes 5, imbricate in bud. Stamens 5, inserted in upper part of corolla tube, partially exerted; filaments short; anthers basifixed. Ovary 2-celled in basal portion, 2–4-celled in upper portion, ovules several in each cell on axile, simple or 2-forked placentas attached to upper third of septum; stigma cylindrical or fusiform, at apex bifid, exerted. Fruiting head with central axis becoming markedly enlarged and fleshy to fibrous. Fruit drupaceous, indehiscent or tardily dehiscent into 4 indehiscent segments or perhaps dehiscent valves, ellipsoid to cylindrical or obconic, with exocarp somewhat fleshy to membranous or papery, with endocarp cartilaginous to bony, with calyx limb persistent; seeds several, small, compressed, fusiform to angled, with testa membranous; endosperm fleshy; embryo small, cylindrical.

Two species: S and SE Asia, Australia, and New Guinea, one species occasionally cultivated for lumber worldwide; one species in China.

The flowers are tightly packed on the thickened axis of the inflorescence heads but not actually fused to each other as has sometimes been (incorrectly) suggested.

The name of this species and its genus have long been confused. Ridsdale (Blumea 24: 307–366. 1979) in his revision of the Naucleae treated

this species as *Anthocephalus chinensis* (Lamarck) A. Richard ex Walpers, as done by several other authors; however, the nomenclature here follows the conclusions of Bosser (loc. cit.: 243–248; *Adansonia* 21: 93–95. 1999) and Razafimandimbison (Tribal Delimit. Naucleae (Ph.D. Diss.): 70–75. 2000).

**1. *Neolamarckia cadamba*** (Roxburgh) Bosser, Bull. Mus. Natl. Hist. Nat., B, *Adansonia* 6: 247. 1985.

团花 tuan hua

*Nauclea cadamba* Roxburgh, Fl. Ind. 2: 121. 1824; *Anthocephalus cadamba* (Roxburgh) Miquel; *A. indicus* A. Richard; *A. indicus* var. *glabrescens* H. L. Li; *Sarcocephalus cadamba* (Roxburgh) Kurz.

Trees, deciduous, to 30 m tall; trunk with small buttresses; bark thin, grayish brown, fissured and scabrous when old; branches horizontally spreading, flattened becoming subterete, glabrescent. Petiole 20–35 mm, glabrous; leaf blade drying thinly leathery, elliptic or oblong-elliptic, on juvenile growth 50–60 × 15–30 cm, on adult growth 15–25 × 7–12 cm, adaxially shiny and glabrous, abaxially glabrous to densely puberulent, base shallowly cordate on juvenile growth, rounded or

truncate on adult growth, apex acute; secondary veins 8–12 pairs, apparently without domatia; stipules lanceolate, 12–20 mm, acute. Inflorescences with peduncle 2–4 cm, rather stout; flowering heads 35–45 mm across calyces, 40–60 mm across corollas. Calyx puberulent to pilosulous; ovary portion ellipsoid to obovoid, ca. 1.5 mm; limb 3–4 mm, partially to deeply lobed; lobes oblong to spatulate, obtuse to rounded. Corolla yellowish white, funnelliform, outside glabrous; tube ca. 10 mm; lobes lanceolate, ca. 2.5 mm. Fruiting heads yellowish green, 30–40 mm in diam., with peduncles markedly thickened. Fruit cylindrical to ellipsoid or obovoid, 2–2.5 × ca. 1 mm, glabrous; seeds 3-angled, 0.5–0.7 mm. Fl. and fr. Jun–Nov.

Broad-leaved forests, streamsides in valleys. Guangdong, Guangxi, Yunnan [Bhutan, India, Malaysia, Myanmar, Sri Lanka, Thailand, Vietnam].

This species is occasionally cultivated for lumber in Asia, including probably in China, and in the Neotropics.

### 63. NEONAUCLEA Merrill, J. Wash. Acad. Sci. 5: 538. 1915.

新乌檀属 xin wu tan shu

Chen Tao (陈涛); Charlotte M. Taylor

*Nauclea* Korthals, Observ. Naubl. Indic. 17. 1839, not Linnaeus (1762).

Trees or shrubs, unarmed; buds flattened with stipules erect and pressed together [to conical], [sometimes with fusiform swellings housing ants in branches]. Raphides absent. Leaves opposite, sometimes with numerous foveolate domatia; stipules caducous [or rarely persistent], interpetiolar, generally ligulate, entire. Inflorescences terminal, capitate with 1–9 globose heads in fascicles or cymes, many flowered, pedunculate, bracteate; peduncles and axes articulate near middle; bracts enclosing heads involucre and caducous; bracteoles spatulate to conical or sometimes absent. Flowers sessile, bisexual, monomorphic. Calyx limb deeply 5-lobed; lobes prolonged into a slender shaft bearing thickened to rhomboidal apical portion, this often ornamented and/or pubescent differently from shaft and frequently deciduous before shaft. Corolla pale green to white or red, salverform to narrowly funnelliform, inside glabrous or glabrescent; lobes 5 [or rarely 6], imbricate in bud. Stamens 5, inserted in corolla throat, partially to fully exerted; filaments short; anthers basifixed. Ovary 2-celled, ovules numerous in each cell, pendulous on axile placentas attached in upper third of septum; stigma globose to obovoid, exerted. Fruiting heads globose. Fruit capsular, obconic, septically then loculicidally dehiscent into 4 valves from base to apex, with valves separating from septum, with septum persistent on inflorescence or later deciduous, woody to cartilaginous, with calyx limb deciduous with capsule valves; seeds numerous, small, fusiform, flattened, winged; embryo ellipsoid, somewhat bilaterally compressed.

About 62 species: tropical Asia and Pacific islands, perhaps ten species in continental Asia; four species (one endemic) in China.

This genus was studied in some detail by Ridsdale (*Blumea* 24: 337–342. 1979; *Blumea* 34: 177–275. 1989). The unusual, usually quite elaborately developed calyx lobes are distinctive of the genus in general, and their form is distinctive for individual species; care must be taken to look for the caducous apical part of the calyx lobes and to not confuse the persistent tubular calyx limb base with the entire calyx limb. Ridsdale (loc. cit. 1989) developed a very detailed terminology, but did not suggest a function, for the calyx lobe morphology of this genus. He also noted that *Neonauclea* has secondary pollen presentation. Ridsdale (loc. cit. 1989) and Zou (J. Arnold Arbor. 69: 73–76. 1988) noted that some *Neonauclea* species are large trees that produce very good lumber.

- 1a. Leaves sessile or subsessile, with petioles to 5 mm; leaf base obtuse to rounded, truncate, or cordulate.
- 2a. Leaf blade elliptic-oblong to elliptic or suborbicular, with 6–9 pairs of secondary veins, with domatia in abaxial axils of secondary, tertiary, and often quaternary veins; corolla tube 5–6 mm ..... 2. *N. sessilifolia*
- 2b. Leaf blade obovate, broadly obovate, broadly elliptic, or elliptic-oblong, with 7–9 pairs of secondary veins, abaxially with domatia only in axils of secondary veins; corolla tube 8–10 mm ..... 3. *N. truncata*
- 1b. Leaves petiolate with petioles 8–40 mm; leaf base acute to cuneate or broadly obtuse, sometimes decurrent.
  - 3a. Petioles 8–20 mm; leaf base acute to cuneate and sometimes decurrent; domatia glabrous; calyx lobes densely pilosulous on middle and lower portion and glabrous at apex, with apical portion fusiform ..... 1. *N. griffithii*
  - 3b. Petioles 15–40 mm; leaf base broadly obtuse to cuneate; domatia tomentulose or glabrous; calyx lobes puberulent throughout except glabrous adaxially in basal portion, with apical portion spatulate to cucullate ..... 4. *N. tsaiiana*

**1. *Neonauclea griffithii*** (J. D. Hooker) Merrill, J. Wash. Acad. Sci. 5: 540. 1915.

新乌檀 xin wu tan

*Adina griffithii* J. D. Hooker, Fl. Brit. India 3: 24. 1880; *Cephalanthus navillei* H. Léveillé; *Nauclea griffithii* (J. D. Hooker) Haviland; *Neonauclea navillei* (H. Léveillé) Rehder.

Trees, evergreen, to 20 m tall; trunk often buttressed at base, sometimes with aerial roots; bark greenish gray, fissured and cracked, sometimes warty, with inner bark yellow, pale brown to pink; branchlets quadrangular becoming terete, grayish brown, rugose or striate, white lenticellate, glabrescent. Petiole 8–20 mm, stout, glabrous; leaf blade drying thickly papery to subleathery, obovate to elliptic, 8–22 × 4–15 cm, both surfaces glabrous, base acute to cuneate and frequently decurrent, apex rounded then abruptly cuspidate or acute; secondary veins 5–7 pairs, in abaxial axils with glabrous domatia; stipules obovate to obovate-oblong, 5–10 × 3–8 mm, weakly keeled, glabrous, apex obtuse. Inflorescences puberulent to glabrescent; peduncles 1 or 3, 2–6 cm; flowering heads solitary, 8–12 mm in diam. across calyces, 25–30 mm in diam. across corollas; involucre bracts not seen; bracteoles 0.5–1 mm. Calyx with ovary portion obconic, 1–1.5 mm, glabrous in lower 2/3, pilosulous in upper 1/3; limb partially lobed, with basal tubular portion ca. 1 mm; lobes with shaft clavate, 3.5–4.5 mm, densely pilosulous, with apical portion fusiform, deciduous before corollas open, pilosulous on lower portions, glabrous at apex. Corolla red (*Henry 12676*, MO!), narrowly funnelliform to salverform, outside glabrous; tube 7–8 mm, inside glabrous to sparsely pubescent; lobes elliptic-oblong, 2–3 mm, acute. Stigmas subglobose, ca. 1 mm, exserted for 5–6 mm. Fruiting heads ca. 20 mm in diam. Capsules obconic, 5–6 mm, pilosulous at least at apex; seeds not seen.

Dense forests in valleys or on humid slopes; 800–1300 m. Guangxi, Guizhou, Yunnan [Bhutan, N India, Myanmar].

**2. *Neonauclea sessilifolia*** (Roxburgh) Merrill, J. Wash. Acad. Sci. 5: 542. 1915.

无柄新乌檀 wu bing xin wu tan

*Nauclea sessilifolia* Roxburgh, Fl. Ind. 2: 124. 1824; *Adina sessilifolia* (Roxburgh) J. D. Hooker ex Brandis; *N. sericea* Wallich ex G. Don.

Trees, leaf persistence unknown, 7–30 m tall; bark dark gray, transversely fissured and cracked, with inner bark brown, sometimes mottled; branches flattened to angled, glabrous. Leaves sessile or subsessile; petiole to 5 mm, stout, glabrous; blade drying papery to thinly leathery, elliptic to elliptic-oblong or suborbicular, 5–30 × 3–15 cm, both surfaces glabrous, base rounded to truncate or cordulate, apex obtuse; secondary veins 6–9 pairs, with small, glabrous to pilosulous, foveolate domatia in abaxial axils of lateral, tertiary, and often quaternary veins; stipules broadly elliptic to obovate, 10–30 × 5–10 mm, glabrous, keeled in lower portion, apex obtuse to broadly rounded. Inflorescences glabrescent; peduncles 1 (or 3), 1–3 (–8) cm; flowering heads solitary, 20–25 mm in diam. across calyces, 35–45 mm in diam. across corollas; involucre bracts not seen; bracteoles linear, 1–2 (–3) mm. Calyx with ovary portion obconic,

1–1.5 mm, glabrous or apically tomentulose; limb partially lobed, with basal tubular portion 0.5–0.8 mm; lobes densely pilosulous, with shaft clavate, 5–7 mm, with apical portion pyramidal, deciduous before corollas open. Corolla color unknown; tube 5–6 mm, inside glabrescent; lobes deltoid to elliptic, 2–3 mm, outside densely strigillose to sericeous, acute. Stigma subglobose, ca. 0.8 mm, exserted for 5–6 mm. Fruiting heads (15–) 25–35 mm in diam. Capsules obconic, 8–10 mm, glabrous except densely pilosulous at apex; seeds ca. 2 mm. Fl. Oct.

Thickets or broad-leaved forests on hills; 500–800 m. Taiwan, Yunnan [Cambodia, India, Laos, Myanmar, Thailand, Vietnam].

This is the first report of this species in Taiwan.

**3. *Neonauclea truncata*** (Hayata) Yamamoto, J. Soc. Trop. Agric. 7: 149. 1935.

台湾新乌檀 tai wan xin wu tan

*Nauclea truncata* Hayata, J. Coll. Sci. Imp. Univ. Tokyo 30(1): 140. 1911.

Trees, evergreen, large, height not noted; branches flattened to angled, gray, glabrous. Leaves sessile or subsessile; petiole to 2 mm, glabrous; blade drying leathery, obovate, broadly obovate, broadly elliptic, or elliptic-oblong, 13.5–26 × 9.9–19.8 cm, glabrous, base rounded to truncate, obtuse, or cordulate, apex obtuse to acute or shortly acuminate; secondary veins 7–9 pairs, in abaxial axils with pilosulous or foveolate domatia; stipules elliptic-oblong to elliptic, 12–25 × 8–15 mm, glabrous, smooth to weakly keeled, rounded to obtuse. Inflorescences densely strigillose to glabrescent; peduncles 1–3 (–5), 2.2–3.5 cm, stout; flowering heads solitary on peduncles, 12–25 mm in diam. across calyces, 34–45 mm in diam. across corollas; bracteoles reportedly sparse, not seen. Calyx with ovary portion 0.8–1.5 mm, glabrous; limb partially lobed, with basal tubular portion 1–1.5 mm, pilosulous at least on apical portion; lobes deciduous before corollas open, with shaft linear, 1.5–2.5 mm, glabrous below and densely pilosulous in upper part, with apical portion obconic to thickly fusiform, 2–2.5 mm, pilosulous to glabrescent. Corolla white, funnelliform; tube 8–10 mm, glabrous; lobes ligulate to lanceolate, 2–3 mm, puberulent, obtuse to acute. Stigma subglobose to fusiform, ca. 1 mm, exserted for 8–10 mm. Fruiting heads 30–35 mm in diam. Capsules obconic, 8–10 mm, glabrescent. Fl. Jul.

Forests, on coral rocks. Taiwan [Philippines].

This species was reported from Taiwan by Chun (Fl. Taiwan 4: 313. 1978) and later by Liu et al. (Fl. Taiwan, ed. 2, 4: 304–306. 1998) under the name *Neonauclea reticulata* (Haviland) Merrill, with the name *N. truncata* placed in synonymy there. However, Yamamoto (loc. cit.) had already noted the differences that separate *N. truncata* and *N. reticulata* and concluded that the name *N. reticulata* had been incorrectly applied to the Taiwanese plants. Ridsdale (Blumea 34: 213–217. 1989) later recognized these as two distinct species and reported an extended range for *N. truncata*, in N Philippines.

**4. *Neonauclea tsaiiana*** S. Q. Zou, J. Arnold Arbor. 69: 73. 1988.

滇南新乌檀 dian nan xin wu tan

Trees, to 30–40 m tall and 1 m d.b.h.; trunk cylindrical,

with buttresses; bark rough, with inner bark fibrous, yellow or sometimes with pink; branches flattened to angled, densely lenticellate, glabrescent. Petiole 12–40 mm, stout, glabrous; leaf blade drying leathery, elliptic or ovate-elliptic, 12–22 × 6–13 cm, adaxially glabrous and rather shiny, abaxially glabrous and matte, base broadly obtuse to cuneate, apex acute to shortly acuminate; secondary veins 6 or 8 pairs, with tomentulose to glabrous foveolate domatia in abaxial axils; stipules ovate, 12–24 × 8–14 mm, glabrous, weakly keeled in basal portion, apex obtuse. Inflorescences glabrous; peduncles 1–3, 2–4.5 cm; flowering heads 1–7 (or 9), solitary on peduncles or 3–7 in branched cymes, 10–18 mm in diam. across calyces, 25–30 mm in diam. across corollas; involucre bracts not seen; bracteoles conical, 0.7–1 mm. Calyx with ovary portion obconic, 1–1.5 mm, glabrous except puberulent at apex; limb partially lobed, with basal tubular portion 0.8–1 mm; lobes deciduous before

corollas open, with shaft clavate, 3–4 mm, densely puberulent except adaxially glabrous in basal portion, apical portion rounded to cucullate, densely puberulent. Corolla pale yellow, funnelform, glabrous; tube 5–6.5 mm; lobes elliptic-oblong, ca. 2.5 × 1.2 mm, apex acute. Stigmas subglobose, ca. 1 mm, exerted for 5–6 mm. Fruiting heads 15–20 mm in diam. Capsules clavate, somewhat flattened, 6–7 mm, glabrous in basal portion, puberulent or pilosulous at apex; seeds unknown. Fl. Sep–Oct, fr. May–Jun.

• Tropical rain forests at streamsides or in bottom of valleys; 500–1100 m. Yunnan.

This species was described almost simultaneously with the publication of Ridsdale's revision of the genus (*Blumea* 34: 177–275. 1989) and was not mentioned by him presumably because he was unaware of it.

#### 64. *NERTERA* Banks ex Gaertner, *Fruct. Sem. Pl.* 1: 124. 1788, nom. cons.

薄柱草属 *bao zhu cao shu*

Chen Tao (陈涛); Charlotte M. Taylor

*Erythrodanum* Thouars; *Gomozia* Mutis ex Linnaeus f.

Herbs, perennial, unarmed, sometimes fetid when bruised, often creeping and rooting at nodes. Raphides present. Leaves opposite, without domatia, marginally usually thickened and sometimes crisped; stipules persistent, interpetiolar and fused to petioles, triangular or bidentate. Inflorescences terminal and/or pseudoaxillary, 1-flowered, sessile or shortly pedunculate, exbracteate or sometimes with small involucre of bracts fused in pairs (i.e., calyculate) or of reduced stipules and leaves. Flowers bisexual, homostylous. Calyx limb truncate, 4-lobed, or reduced. Corolla greenish white, white, or pink, funnelform, glabrous inside; lobes 5, valvate in bud. Stamens 4, inserted near base of corolla tube, exerted; filaments developed; anthers basifixed. Ovary 2- or 4-celled, ovules 1 in each cell on axile placentas; stigmas 2 or 4, linear, exerted. Fruit orange, red, or black, drupaceous, ovoid or globose, fleshy, with calyx limb persistent; pyrenes 2 or 4, 1-celled, each with 1 seed, plano-convex, cartilaginous; seeds medium-sized, ellipsoid to plano-convex; testa membranous; endosperm scanty; cotyledons leaflike; hypocotyl hypogenous.

About six species: Antilles, Australia, Central, North, and South America, China, Indonesia, Malaysia, Pacific islands, Papua New Guinea, Philippines, Subantarctic islands (Tristan da Cunha), Vietnam; three species (one endemic) in China.

Phylogeography of the most widespread species *Nertera granadensis* (as *N. depressa*) was studied by Jakubowksy et al. (Evolution of *Nertera*. Poster presented at XVII IBC. 2005) using molecular data; they concluded that this species originated in New Zealand, where *Nertera* has its center of diversity, and dispersed independently to Australia, the Philippines, then SE Asia and Hawaii, and then Central and South America and eastward. They also suggested that *N. nigricarpa* may be better included within the circumscription *N. granadensis*, although species identity and circumscription were not the primary focus of their work so their sampling many not be adequate to address this. *Nertera nigricarpa* is distinguished primarily by its black rather than red mature fruit and was synonymized with *N. granadensis* by Liu and Yang (*Fl. Taiwan*, ed. 2, 4: 306. 1998), without comment; however, these species were separated by W. C. Ko in *FRPS* (71(2): 162–165. 1999). If these populations are treated as conspecific, this represents the only example known in *Nertera* of such fruit color dimorphism, which is known but uncommon in Rubiaceae. *Nertera nigricarpa* is provisionally separated here pending further study.

Liu and Yang (loc. cit.) and W. C. Ko (loc. cit.) described the flowers as bisexual or unisexual, but other authors reported the flowers of *Nertera* to be bisexual (e.g., Fosberg, *Acta Phytotax. Geobot.* 33: 73–83. 1982; Andersson, *Fl. Ecuador* 47: 11–12. 1993).

- 1a. Leaf blade oblong-lanceolate to elliptic, cuneate to acute at base and apex, abaxially with surface uneven due to swollen cells, on dry specimens appearing scurfy; fruit with 4 pyrenes ..... 3. *N. sinensis*  
 1b. Leaf blade ovate, broadly ovate, ovate-triangular, or ovate-reniform, acute to obtuse or broadly rounded at apex, abaxially generally smooth; fruit with 2 pyrenes.  
 2a. Leaves acute to obtuse at apex; fruit red ..... 1. *N. granadensis*  
 2b. Leaves obtuse to broadly rounded at apex; fruit black ..... 2. *N. nigricarpa*

1. *Nertera granadensis* (Mutis ex Linnaeus f.) Druce, *Rep. Bot. Soc. Exch. Club Brit. Isles* 1916: 637. 1917.

129. 1782; *Nertera depressa* Banks & Solander ex Gaertner; *N. taiwaniana* Masamune.

红果薄柱草 *hong guo bao zhu cao*

*Gomozia granadensis* Mutis ex Linnaeus f., *Suppl. Pl.*

Creeping herbs; stems angled, glabrescent. Petiole slender, 2–4 mm, glabrescent; leaf blade drying papery and often pale abaxially, ovate or ovate-triangular, 0.3–1 × 0.2–0.8 cm, gla-

brescent, generally smooth abaxially, base obtuse to shallowly cordate, apex acute to obtuse; secondary veins 2 or 3 pairs; stipules ovate-triangular, 0.5–1 mm, glabrescent, apex acute and often glandular. Flowers sessile or subsessile. Calyx glabrous; ovary portion ellipsoid, ca. 1 mm; limb reduced. Corolla white to pale green, glabrous; tube 0.5–1 mm; lobes ca. 1 mm. Drupes red, subglobose, 3–5 mm in diam.; pyrenes 2.

Hillsides at middle elevations. Taiwan [Indonesia, Malaysia, Papua New Guinea, Philippines; Australia, Central America (Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama), North America (Mexico), Pacific islands (Hawaii, New Zealand), South America (Argentina, Bolivia, Chile, Colombia, Ecuador, Peru, Venezuela), Subantarctic islands (Tristan da Cunha)].

See comments under the genus regarding the distinction of this species from *Nertera nigricarpa*. No specimens have been seen from China during the preparation of this treatment that correspond to *N. granadensis*, separately from *N. nigricarpa*; thus, its presence in China remains to be confirmed and the placement of the name *N. taiwaniana* remains to be confirmed. Puff et al. (Rubiaceae of Thailand, 210. 2005) reported that *N. granadensis* has been recorded for Thailand, but they found no specimens nor the source of that report.

This species has often been called *Nertera depressa*, the type of the genus; however, *Gomozia granadensis* is an older name for this species and thus has priority over the epithet “*depressa*,” so the correct name is *N. granadensis*.

**2. *Nertera nigricarpa*** Hayata, J. Coll. Sci. Imp. Univ. Tokyo 25(19): 115. 1908.

黑果薄柱草 *hei guo bao zhu cao*

Creeping herbs; stems quadrate, glabrous. Petiole 1–8 mm, glabrous; leaf blade drying papery, broadly ovate or ovate-renaliform, 0.25–1 × 0.3–1.1 cm, glabrous, generally smooth abaxially, base rounded to truncate or cordulate then abruptly

attenuate, apex obtuse to broadly rounded; secondary veins 2 or 3; stipules broadly triangular, 1–1.3 mm, glabrous, acute and often glandular. Flowers sessile. Calyx glabrous; ovary portion ovoid, ca. 1 mm; limb truncate to denticulate, 0.1–0.2 mm. Corolla probably pale green, urceolate-funnelform, glabrous; tube ca. 1 mm; lobes triangular, ca. 0.4 mm. Drupes black, ellipsoid to subglobose, 4–4.5 in diam., glabrous; pyrenes 2. Fl. Feb–Jul, fr. Mar–Jan.

Sparse forests, open fields; 900–2500 m. Fujian, Taiwan [Vietnam (*Averyanov et al. VH 427, MO!*)].

See comments under the genus description regarding the relationship of this species to *Nertera granadensis*. This is apparently the first report of this species from Vietnam.

**3. *Nertera sinensis*** Hemsley, J. Linn. Soc., Bot. 23: 391. 1888.

薄柱草 *bao zhu cao*

Low herbs, with main stems creeping and reproductive stems erect, to 10 cm tall; stems angled, glabrous. Petiole 1–3 mm, glabrous; leaf blade drying papery, oblong-lanceolate to elliptic, 0.7–1.6 × 0.35–0.5 cm, glabrous or sparsely hispidulous on both surfaces, abaxially rough due to enlarged thin-walled cells that dry with scurfy appearance, base cuneate to acute, margins hispidulous, apex acute to cuneate; secondary veins not visible; stipules narrowly triangular, 0.8–1 mm, obtuse to acute or aristate and usually glandular. Flowers sessile. Calyx glabrous; ovary portion 1–1.5 mm; limb truncate, 0.1–0.2 mm. Corolla pale green, funnelform, glabrous; tube ca. 1 mm; lobes triangular, ca. 0.5 mm, acute to obtuse. Drupes dark blue to black, subglobose, 2–6 mm in diam.; pyrenes 4. Fl. Jul–Aug, fr. Jul–Nov.

• Mountain slopes, roadsides, ditch sides, rocks at riversides; 500–1300 m. Guangdong, Guangxi, Guizhou, Hubei, Hunan, Jiangxi, Sichuan, Yunnan.

## 65. OPHIORRHIZA Linnaeus, Sp. Pl. 1: 150. 1753.

蛇根草属 *she gen cao shu*

Chen Tao (陈涛); Charlotte M. Taylor

*Hayataella* Masamune; *Mitreola* Boehmer; *Mungos* Adanson.

Annual or perennial herbs or rarely shrubs, unarmed, often fleshy or rather succulent, sometimes creeping. Raphides present. Leaves opposite, decussate, sometimes anisophyllous, without domatia; margins sometimes undulate to denticulate; stipules persistent or caducous, interpetiolar, entire or bifid to fimbriate, sometimes glandular. Inflorescences terminal and/or pseudoaxillary or rarely axillary (*Ophiorrhiza oppositifolia*), cymose to capitate, fasciculate, or paniculiform with axes often helicoid, few to many flowered, sessile to pedunculate, bracteate or bracts absent; bracts caducous to persistent, sometimes involucrel. Flowers pedicellate to sessile, bisexual and distylous or monomorphic or occasionally cleistogamous. Calyx with ovary portion turbinate to obconical, usually strongly compressed, longitudinally often 5- or 10-ribbed; limb reduced or 5(or 6)-lobed, lobed essentially to base or rarely subtruncate (*O. repandicalyx*). Corolla white, yellow, orange, pink, purple, or brown, sometimes drying with markedly different color, usually notably clavate in bud, at anthesis salverform, tubular, or funnelform with tube often swollen to gibbous at base, outside often longitudinally ridged or winged, inside glabrous to variously pubescent; lobes 5(or 6), valvate in bud, smooth or occasionally ridged, winged, and/or with hornlike appendages near apex, apex sometimes adaxially rostrate. Stamens 5(or 6), inserted near throat to below middle of corolla tube, included or exserted; filaments reduced to well developed; anthers dorsifixed near middle or base. Ovary 2-celled, ovules numerous in each cell on axile placentas attached from middle to base of septum; stigmas 2, linear to subcapitate, included or exserted. Fruit capsular, obovoid to obovate, mitriform, or obcordate, strongly laterally compressed perpendicular to septum, sometimes with apical portion prolonged into a beak, loculicidally dehiscent across top and sometimes along sides, papery, with calyx limb persistent; seeds numerous, small, angled to rhomboid, areolate to alveolate.

About 200–300 species: tropical and subtropical Asia, Australia, New Guinea, Pacific islands; 70 species (49 endemic, one of unconfirmed occurrence) in China.

*Ophiorrhiza* is a notably species-rich, taxonomically complicated genus found in wet tropical forests of SE Asia (Darwin, *Lyonia* 1(2): 47–102. 1976); it has been little studied and is particularly poorly known in SE Asia (I. Schanzer, pers. comm.). *Ophiorrhiza* was studied for China by H. S. Lo (Bull. Bot. Res., Harbin 10(2): 1–82. 1990), who variously described 44 of the 68 *Ophiorrhiza* species recognized by Lo in FRPS (71(1): 110–174. 1999). The genus was studied in India by Deb and Mondal (Bull. Bot. Surv. India 39(1–4): 1–148. 1997), who recognized 47 species there. Darwin (loc. cit.) reported that the plants are notably variable in many vegetative features, many of which were shown by him not to be informative to separate species. H. S. Lo (loc. cit. 1999: 111) reported that the calyx and corolla lobes are occasionally 6, but this has not been noted by other authors nor seen on specimens studied; this may be an occasional variation found in one or two flowers on unusual plants, as in many Rubiaceae species. H. S. Lo also described the placentas as ascending from the septum base; however, Darwin (loc. cit.: 56) reported that in the Pacific *Ophiorrhiza* species the placenta is inserted in the middle of the septum in the flower and then often becomes displaced to near the base of the septum in fruit, whereas Puff et al. (Rubiaceae of Thailand, 190. 2005) gave the insertion of the placenta as being in the lower half of the septum. Puff et al. reported that the fruit function as splash cups for seed dispersal and observed that, regardless of the orientation of the flowers, the fruit become erect with enlarged and strengthened pedicels. Tan and Rao (Biotropica 13: 232–233. 1981) reported vivipary in a species of *Ophiorrhiza* growing in Singapore, with the seeds germinating within the capsules, pushing their cotyledons out through the suture where the valves open normally, and extending roots through the capsule locules and tissues; a similar condition may be found in Chinese *Ophiorrhiza*.

Darwin (loc. cit.: 47–102) noted that the presence of distyly in *Ophiorrhiza* has been controversial because the arrangement of the stigmas and anthers in the first dimorphic species found here differs from that of classic distyly, with strictly reciprocal sizes and positions. However, since then the recognition of distyly in Rubiaceae has expanded to include species that are at least a bit dimorphic and have intra-morph incompatibility, and *Ophiorrhiza* clearly belongs in this group and has been considered distylous by subsequent authors (Deb & Mondal, loc. cit.; Kudoh et al., J. Trop. Ecol. 17: 719–728. 2001; Schanzer, Thai Forest Bull. 33: 140–166. 2004). Also, some species with markedly dimorphic distylous flowers have subsequently been discovered (e.g., *O. aureolina* and *O. rufopunctata*). Deb and Mondal (loc. cit.: 15, f. 7) illustrated some of the variation in stamen and stigma position and internal corolla pubescence in distylous species of this genus. Homostyly has also been confirmed in the genus (Nakamura et al., J. Jap. Bot. 81: 113–120. 2006; J. Plant Res. 120: 501–509. 2007) and some species also appear to be autogamous (Nakamura et al., loc. cit. 2006). Schanzer (loc. cit.) noted that some species appear to vary in floral biology across their range, to include both homostylous and distylous populations; this situation has been found elsewhere in some distylous Rubiaceae, which have variation in expression of distyly (e.g., Faivre & McDade, Amer. J. Bot. 88: 841–853. 2001), though in those cases, the flowers resemble one of the distylous forms while Schanzer described a distinct floral form in the monomorphic plants. Schanzer also noted that some of these floral forms may be aberrant and cleistogamous rather than distylous. Nakamura et al. (loc. cit. 2007) studied two supposedly conspecific varieties of *O. japonica* in Japan, one homostylous and the other distylous, and concluded that the self-compatible homostylous plants differed in ploidy level, comprised a distinct lineage according to cpDNA sequences, and are better considered a separate species. They also noted that floral biology is not correlated with ploidy in general in *Ophiorrhiza*. Observations and documentation of the floral biology of Chinese *Ophiorrhiza* species are so far limited. Kudoh et al. (loc. cit.) presented a detailed analysis of the floral forms and possible genetic controls of these in *O. napoensis* in Guangxi, China. Also notable in the floral morphology of this genus is the apparent wide variation in corolla pubescence within a species, sometimes with the long-styled and short-styled flowers reportedly different (e.g., *O. oppositiflora*, floral forms similar but corolla pubescence variable, Deb & Mondal, loc. cit.: 88, f. 39; *O. austroyunnanensis*, pubescence apparently correlated with floral form, H. S. Lo, loc. cit. 1990: 31, f. 8).

Deb and Mondal (loc. cit.: 1) noted that the genus name alludes to the presumed healing properties of the root of these plants for snakebite and that *Ophiorrhiza mungos* and *O. japonica* are used for such in the Indian subcontinent. They also noted that species of this genus are used as medicine (for snakebites, stomach ulcers, skin eruptions, rheumatism, heart diseases), dye (red, for wool and hair), and food (the fruit), and list several references detailing their ethnobotany and medical chemistry.

The monotypic genus *Hayataella*, endemic to Taiwan, was recognized by several authors (particularly Taiwanese authors) as distinct from *Ophiorrhiza*, though it was synonymized by H. S. Lo (Bull. Bot. Res., Harbin 18: 276–277. 1998). Its morphology and molecular systematics were studied by Nakamura et al. (J. Plant Res. 119: 657–661. 2006), who concluded based on molecular data that the species belongs to a relatively derived clade of *Ophiorrhiza* and formally transferred the species, eliminating another of Taiwan's few endemic genera.

No infrageneric classification has been recognized by recent authors (Darwin, loc. cit.: 47–102; Deb & Mondal, loc. cit.: 1–148).

H. S. Lo (loc. cit. 1990: 1–82) presented the definitive work on this genus in China. Most recently, *Ophiorrhiza* has been studied in China by Duan and Lin (Acta Phytotax. Sin. 45: 870–879. 2007), who synonymized several of Lo's species. Their species circumscription is relatively broad compared to that of Lo, and a few of the species they synonymized are provisionally recognized here pending further study and a broader, consistent review of *Ophiorrhiza* in China.

Overall, the treatment of *Ophiorrhiza* here is primarily an organization of the published information, rather than a revisionary work. A few other species are keyed here even though their descriptions are incomplete; their placement is based in part on the key of H. S. Lo in FRPS (loc. cit. 1999: 112–117). In the FRPS treatment, H. S. Lo described in some detail the arrangement and degree of surface development and visibility of the tertiary venation on the abaxial leaf surface of many *Ophiorrhiza* species; however, this is incompletely described for the Chinese species, is variable within species, and was not used by Lo to distinguish species nor by other authors and, therefore, is not detailed here. Details of the anthers and stigmas are also incompletely described for Chinese *Ophiorrhiza* and mostly not used to separate species; the details available are summarized in the comments following the species description.

Among the names published in *Ophiorrhiza* by H. S. Lo (loc. cit. 1990), eight lacked an acceptable indication of type and were therefore not validly published under Art. 37 of the *Vienna Code*. In one case (*O. chingii*), two gatherings were cited but neither was indicated as the type, and in the other seven cases only one gathering was cited, which under Art. 37.3 is acceptable as indication of the type, but under Art. 37.6, on or after 1 January

1990, indication of the type must also include the word “typus” or “holotypus” or an equivalent in a modern language, and Lo did not include such words. All but one of the eight names were validated by S. Y. Jin and Y. L. Chen (Cat. Type Spec. Herb. China (Suppl.), 189–191. 1999) in each case by reference to Lo’s Latin description and by indication of a single gathering as the type (as “T.”). The one remaining name, *O. longicornis*, is validated here.

- 1a. Calyx lobes relatively well developed, longest ones 3.5 mm or longer (do not confuse bracts with calyx lobes).
- 2a. Calyx lobes strongly unequal, more than 50% different in length, longer ones 3–6 mm and shorter ones 0.8–3 mm ..... 52. *O. pingbienensis*
- 2b. Calyx lobes subequal, at most 50% different in length, 3.5–8 mm.
- 3a. Corolla purple, tube 26–29 mm; stipules 1.5–2 mm ..... 64. *O. sichuanensis*
- 3b. Corolla white or yellow, tube 13–19 mm (mature corolla unknown in *O. hunanica*); stipules 3–10 mm.
- 4a. Stems glabrescent; calyx lobes linear; corolla externally with ciliate wings ..... 27. *O. hunanica*
- 4b. Stems pilosulous or villous at least when young; calyx lobes linear, spatulate, or ovate; corolla externally smooth to ridged or with narrow, glabrous to pubescent wings.
- 5a. Stipules ca. 10 mm, 2- or 3-lobed, lobes linear; bracts 10–20 mm; calyx lobes linear ..... 41. *O. medogensis*
- 5b. Stipules 3–9 mm, triangular or 2-lobed; bracts 5–7 mm; calyx lobes ligulate, narrowly spatulate, ovate, or lanceolate.
- 6a. Corolla with tube 13–14 mm and externally ridged or ribbed, lobes 2–2.5 mm; leaves in subequal pairs ..... 15. *O. ensiformis*
- 6b. Corolla with tube 18–19 mm and externally ridged to winged, lobes ca. 4.5 mm; leaves in unequal pairs ..... 60. *O. rufipilis*
- 1b. Calyx lobes none (i.e., limb truncate) or longest lobes 3.4 mm or shorter (calyx lobe length unknown in *O. rarior*).
- 7a. Inflorescences axillary, paired at nodes below apex ..... 49. *O. oppositiflora*
- 7b. Inflorescences terminal and/or pseudoaxillary, solitary at each node.
- 8a. Stems densely lenticellate and moderately brown villous or -hirsute with multicellular trichomes when young ..... 56. *O. rarior*
- 8b. Stems sparsely lenticellate to smooth, glabrous to densely pubescent with trichomes of various colors and forms when dry.
- 9a. Corollas relatively small, tube 5.5 mm or shorter (corollas unknown in *O. salicifolia*).
- 10a. Leaves lanceolate-linear, 6 or more × as long as wide ..... 63. *O. salicifolia*
- 10b. Leaves variously shaped, 3 × as long as wide or broader.
- 11a. Corolla lobes with well-developed dorsal horns or appendages, these 1.5–2 mm.
- 12a. Inflorescences congested-cymose, branched to 1 or 2 orders; corolla pubescent in throat but glabrous below inside tube, pubescent externally ..... 6. *O. cana*
- 12b. Inflorescences cymose to corymbose, branched to 3 or 4 orders; corolla pubescent below middle inside tube, glabrous externally ..... 35. *O. longicornis*
- 11b. Corolla lobes dorsally smooth, ribbed, winged, or with thickenings or short hornlike protuberances, these up to 0.8 mm.
- 13a. Bracts and bracteoles well developed, lanceolate to spatulate or elliptic, 1–3 mm wide, partially to fully enclosing buds and flowers.
- 14a. Stipules ovate ..... 4. *O. austroyunnanensis*
- 14b. Stipules triangular at base, quickly narrowed to a linear apex or linear lobes ..... 38. *O. lurida*
- 13b. Bracts and bracteoles reduced or linear to triangular, 0.1–0.8 mm wide, not enclosing buds or flowers.
- 15a. Plants creeping or at least relatively small, at most 30 cm tall and most plants much shorter.
- 16a. Stipules 1–3 mm, caducous and often not visible; fruit 5–7 mm wide ..... 53. *O. pumila*
- 16b. Stipules 4–10 mm, usually persisting on uppermost nodes; fruit 4–5 mm wide.
- 17a. Leaves strigillose to glabrous adaxially ..... 24. *O. hispidula*
- 17b. Leaves sparsely hispidulous adaxially ..... 62. *O. rugosa*
- 15b. Plants mostly weakly ascending to erect, generally rather robust, most plants 30 cm tall or taller.
- 18a. Plants when dry covered with golden yellow pubescence, including on corollas ..... 3. *O. aureolina*
- 18b. Plants glabrous or with pubescence drying white to brown, reddened, or clear.
- 19a. Plants to 80–100 cm tall, with leaves 15–22 × 6–10 cm, with 11–19 pairs of secondary veins; calyx limb undulate to shallowly to moderately lobed.
- 20a. Stipules deciduous after uppermost nodes, 4–8 mm; corolla tube 2.5–4 mm ..... 43. *O. mungos*
- 20b. Stipules caducous, unknown; corolla tube ca. 5.5 mm ..... 57. *O. repandicalyx*
- 19b. Plants to 70 cm tall, with leaves 2–15 × 1–6 cm, with (4 or) 5–11 (–19) pairs of secondary veins; calyx limb shallowly to deeply lobed.
- 21a. Stipules 3–8 mm, deciduous after uppermost nodes; Taiwan ..... 29. *O. kuroiwaiae*

- 21b. Stipules caducous and unknown, or persistent on uppermost nodes and 2–11 mm; mainland (including Hainan).
- 22a. Inflorescences well developed, cymose to paniculate; secondary leaf veins 7–19 pairs.
- 23a. Stipules caducous; corollas 3.5–5 mm ..... 43. *O. mungos*
- 23b. Stipules mostly persistent; corollas 6–6.5 mm ..... 49. *O. oppositiflora*
- 22b. Inflorescences somewhat reduced, congested-cymose to subcapitate; secondary leaf veins (4 or)5–7(–11) pairs.
- 24a. Corolla with pubescent ring inside tube, with lobes 1/4–1/3 as long as tube and spreading at anthesis ..... 62. *O. rugosa*
- 24b. Corolla pubescent in throat and on upper part of tube but glabrous through most of tube, with lobes 1/3–1/2 as long as tube and spreading to strongly reflexed at anthesis.
- 25a. Stipules triangular, 2–4 mm; corolla tube 2.5–4.5 mm, lobes spreading at anthesis ..... 38. *O. lurida*
- 25b. Stipules subfiliform, ca. 6 mm; corolla tube 4.5–5 mm, lobes strongly reflexed at anthesis ..... 70. *O. wui*
- 9b. Corollas larger, tubes more than 5.5 mm (corollas unknown in *O. hainanensis* and *O. salicifolia*).
- 26a. Leaves relatively narrow, more than 3 × as long as wide, often falcate, 4.5–11 × 0.6–2 cm.
- 27a. Stems with 2 discrete lines of pubescence; bracteoles 1.5–3 mm ..... 34. *O. lignosa*
- 27b. Stems glabrescent; bracteoles 4–5 mm ..... 63. *O. salicifolia*
- 26b. Leaves rather narrow to relatively broad, less than 3 × as long as wide, 0.5–25 × 0.3–10 cm.
- 28a. Corolla lobes dorsally with well-developed hornlike appendages 0.8–2 mm.
- 29a. Plants robust, to 2.5 m tall, leaves 10–20 × 4–7.5 cm, with 15 or 16 pairs of secondary veins ..... 44. *O. mycetiifolia*
- 29b. Plants smaller to somewhat robust, to 1 m tall, leaves 2–17 × 2–4.5 cm, with 6–13 pairs of secondary veins.
- 30a. Corolla tube 22–24 mm ..... 25. *O. howii*
- 30b. Corolla tube 10.5–12 mm.
- 31a. Leaves with secondary veins 8–12 pairs; calyx lobes 0.4–0.5 mm ..... 19. *O. gracilis*
- 31b. Leaves with secondary veins 6 or 7 pairs; calyx lobes ca. 1.5 mm ..... 55. *O. purpureonervis*
- 28b. Corolla lobes dorsally smooth, ridged, winged, and/or with dorsal thickenings on lobes, these sometimes hornlike but 0.7 mm or shorter.
- 32a. Plants creeping to procumbent, with most internodes prostrate and/or most nodes rooting.
- 33a. Corolla with tube 15–20 mm, lobes 5–6.5 mm.
- 34a. Corolla externally with 5 pubescent lines ..... 42. *O. mitchelloides*
- 34b. Corolla externally glabrous or uniformly pubescent ..... 33. *O. liangkwanensis*
- 33b. Corolla with tube 7–12 mm, lobes 2–5 mm.
- 35a. Corolla lobes ca. 2 mm; stems glabrescent or pilosulous in lines ..... 30. *O. kwangsiensis*
- 35b. Corolla lobes 2.2–5 mm; stems generally uniformly villous, hirtellous, or pilosulous.
- 36a. Bracts well developed, 3.5–6 mm; leaf base regularly cordate ..... 11. *O. cordata*
- 36b. Bracts reduced, 1–2 mm; leaf base obtuse, truncate, or sometimes cordulate.
- 37a. Corolla lobes 2.5–3 mm ..... 14. *O. dulongensis*
- 37b. Corolla lobes 4–5 mm ..... 26. *O. huanjiangensis*
- 32b. Plants erect to weak, with most internodes ascending and most nodes not rooting.
- 38a. Corolla with tube 18–27 mm.
- 39a. Bracts and bracteoles well developed, enclosing buds and at least partially flowers, ligulate, lanceolate, ovate, elliptic, or elliptic-oblong, 10–18 mm.
- 40a. Stems villous; corolla funnelform at least in upper part.
- 41a. Corolla lobes not evidently veined, ca. 5 mm ..... 20. *O. grandibracteolata*
- 41b. Corolla lobes pinnately veined, 6–8 mm ..... 58. *O. rhodoneura*
- 40b. Stems glabrous; corolla salverform to funnelform.
- 42a. Corolla funnelform, tube villous inside above middle ..... 16. *O. fangdingii*
- 42b. Corolla salverform to funnelform, tube glabrous inside ..... 46. *O. napoensis*
- 39b. Bracts and bracteoles reduced to developed, not enclosing or covering buds or flowers, linear, narrowly triangular, or narrowly lanceolate, 5.5 mm or shorter.
- 43a. Stems villous, villosulous, hirsute, hispidulous, strigose, strigillose, or pilosulous.
- 44a. Calyx lobes 0.4–1.5 mm; flowers several to many.
- 45a. Peduncle 1.5–3.5 cm; corolla tube 18–20 mm, pubescent inside ..... 9. *O. chinensis*
- 45b. Peduncle 1–1.5 cm; corolla tube 23–27 mm, glabrous inside ..... 68. *O. wallichii*
- 44b. Calyx lobes 1–3 mm; flowers 1–5.

- 46a. Corolla tube 22–26 mm; leaves without gland dots abaxially ..... 54. *O. purpurascens*
- 46b. Corolla tube 18–22 mm; leaves with or without gland dots abaxially.
- 47a. Leaves without or usually with reddish gland dots abaxially; fruit 5–6 × ca. 11 mm ..... 61. *O. rufopunctata*
- 47b. Leaves without gland dots abaxially; fruit ca. 3 × 8 mm ..... 69. *O. wenshanensis*
- 43b. Stems glabrous to puberulent.
- 48a. Leaves broadly ovate to broadly elliptic, abaxially with numerous small scales ..... 12. *O. crassifolia*
- 48b. Leaves elliptic, lanceolate, ovate, ovate-oblong, or elliptic-oblong, glabrous to variously pubescent but without scales.
- 49a. Stipules generally persistent at least on uppermost nodes, 6–8 mm ..... 39. *O. macrantha*
- 49b. Stipules generally caducous, unknown or perhaps reduced.
- 50a. Calyx lobes unequal, 0.7–2 mm ..... 45. *O. nandanica*
- 50b. Calyx lobes subequal, 0.4–1.5 mm.
- 51a. Fruit 14–15 mm wide ..... 68. *O. wallichii*
- 51b. Fruit 8–11 mm wide.
- 52a. Leaves 3.5–15 cm, with 9 or 10 pairs of secondary veins; corolla white to pale purple-red; widespread ..... 9. *O. chinensis*
- 52b. Leaves 9–15 cm, with 10–14 pairs of secondary veins; corolla red to purplish red; Xizang, Yunnan ..... 67. *O. umbricola*
- 38b. Corolla with tube less than 18 mm (corolla unknown in *O. hainanensis*).
- 53a. Stipules generally well developed, 3–16 mm, and persistent at least on uppermost nodes of flowering stems.
- 54a. Calyx lobes rather well developed, 1.5–2.5 mm with at least some longer than 1.5 mm.
- 55a. Leaves larger, 6.5–22 × 2.5–10 cm; bracts 7–9 mm ..... 40. *O. macrodonta*
- 55b. Leaves smaller, 1–4 × 0.6–2.5 cm; bracts reduced, to ca. 1 mm ..... 14. *O. dulongensis*
- 54b. Calyx lobes smaller, 0.5–1.5 mm with at least some shorter than 1.5 mm.
- 56a. Bracts and bracteoles reduced, to 3 mm, mostly or all deciduous before anthesis.
- 57a. Leaves smaller, 2–11 × 1–5 cm; corollas pubescent inside, glabrous to pubescent outside ..... 62. *O. rugosa*
- 57b. Leaves larger, 6.5–25 × 2–10 cm; corollas glabrous inside and puberulent to glabrous outside.
- 58a. Corollas yellow to pale yellow; peduncles in flower 3–10 cm (these later elongating in fruit) ..... 48. *O. ochroleuca*
- 58b. Corollas purplish red; peduncles in flower 2.5–5 cm (these later elongating in fruit) ..... 59. *O. rosea*
- 56b. Bracts and bracteoles generally well developed, 3–12 mm, generally persistent at least through anthesis.
- 59a. Leaves in markedly unequal pairs, larger ones 1.5–3 × as long as shorter.
- 60a. Corolla pink or purplish red, tube ca. 11 mm, lobes ca. 1.5 mm and dorsally with short hornlike appendage ..... 5. *O. brevidentata*
- 60b. Corolla white, tube ca. 9 mm, lobes 2–3 mm and dorsally narrowly winged ..... 47. *O. nutans*
- 59b. Leaves in subequal pairs.
- 61a. Leaves larger, at least some 10–16 × 4–6.5 cm; peduncles in flower 1–8 cm.
- 62a. Peduncle in flower 1.5–2 cm; bracts 3–4 mm; corolla pubescent inside ..... 23. *O. hispida*
- 62b. Peduncle in flower 1–8 cm; bracts 6–12 mm; corolla glabrous inside.
- 63a. Calyx with hypanthium portion 1–1.5 mm, lobes 1–1.2 mm ..... 17. *O. fasciculata*
- 63b. Calyx with hypanthium portion ca. 3 mm, lobes ca. 0.5 mm ..... 48. *O. ochroleuca*
- 61b. Leaves smaller, 0.8–13 × 0.5–4 cm; peduncles in flower 0.5–6 cm.
- 64a. Peduncle in flower 1–3 cm; bracts 3–6.5 mm; leaves obtuse at apex ..... 50. *O. pauciflora*
- 64b. Peduncle in flower 0.5–6 cm; bracts 5–10 mm; leaves acute to cuspidate or acuminate at apex.
- 65a. Plants viscid puberulent, trichomes unicellular and not drying particularly dark; leaves with secondary veins 15–17 pairs; Hainan ..... 21. *O. hainanensis*
- 65b. Plants villous, trichomes multicellular, drying reddish brown, not glandular; leaves with secondary veins 9–15 pairs; mainland ..... 47. *O. nutans*
- 53b. Stipules caducous and not seen, or 3 mm or shorter.
- 66a. Calyx and fruit densely tuberculate with peglike, flat- to round-topped protuberances; Taiwan ..... 22. *O. hayatana*
- 66b. Calyx and fruit smooth, glabrous to pubescent with slender trichomes.
- 67a. Plants drying purple throughout (on live plants, see old and dying tissues).

- 68a. Corolla with tube 9–14 mm; leaves 4–11 × 0.7–3.5 cm; bracts 1–6 mm ..... 28. *O. japonica*
- 68b. Corolla with tube 7–10 mm; leaves 5–20 × 2.5–8 cm, at least some longer than measurements in alternate lead; bracts 6–9 mm ..... 66. *O. succirubra*
- 67b. Plants drying green, brown, yellowed, gray, blackened, or with parts flushed purple.
- 69a. Stems (but not necessarily inflorescences) villous to hispid with well-developed spreading trichomes.
- 70a. Calyx lobes ca. 0.5 mm; corolla pale purple or white, with tube 10–12 mm and lobes ca. 1 mm ..... 23. *O. hispida*
- 70b. Calyx lobes 1–1.3 mm; corolla yellowish white or tinged with purple, with tube ca. 16 mm and lobes 5–5.5 mm ..... 36. *O. longipes*
- 69b. Stems glabrous or strigillose, puberulent, hispidulous, and/or villosulous with short, appressed to spreading trichomes.
- 71a. Leaves relatively broad, less than 2 × as long as wide, 11–16 × 5.5–10 cm ..... 8. *O. carnosicaulis*
- 71b. Leaves moderately broad to rather narrow, 2 or more × as long as wide, 1.5–20 × 0.7–7 cm.
- 72a. Leaves with secondary veins 13–23 pairs, at least some leaves with more than 13 pairs.
- 73a. Calyx puberulent; corolla lobes 1.8–4 mm, dorsally winged ..... 7. *O. cantonensis*
- 73b. Calyx hispidulous; corolla lobes ca. 1.5 mm, with short hornlike appendage ..... 13. *O. densa*
- 72b. Leaves with secondary veins 4–15 pairs, at least some leaves with fewer than 13 pairs.
- 74a. Bracteoles well developed, 7–12 mm ..... 2. *O. alatiflora*
- 74b. Bracteoles none, reduced, or moderately well developed, 6 mm or shorter.
- 75a. Bracts and bracteoles reduced or caducous, not or hardly visible.
- 76a. Leaves in unequal pairs, with secondary veins prominent adaxially ..... 37. *O. luchuanensis*
- 76b. Leaves in subequal pairs, with secondary veins flat to impressed adaxially.
- 77a. Leaves with 5 or 6 pairs of secondary veins; stems puberulent to glabrescent ..... 31. *O. laevifolia*
- 77b. Leaves with 7–15 pairs of secondary veins; stems glabrous, puberulent, or hispidulous.
- 78a. Leaves rounded-obtuse at apex ..... 65. *O. subrubescens*
- 78b. Leaves acute or acuminate at apex.
- 79a. Stems hispidulous ..... 49. *O. oppositiflora*
- 79b. Stems glabrous or puberulent.
- 80a. Corolla tube ca. 12 mm ..... 1. *O. alata*
- 80b. Corolla tube 4–8 mm ..... 49. *O. oppositiflora*
- 75b. Bracts and bracteoles developed, evident, persisting at least with flowers, bracteoles 1–6 mm.
- 81a. Leaves mostly or all in markedly unequal pairs, longer ones 2–3 or more × as long as shorter.
- 82a. Leaf pairs with longer ones 3 or more × as long as shorter; inflorescences pilosulous or puberulent with slender trichomes ..... 10. *O. chingii*
- 82b. Leaf pairs with longer ones 2–2.5 × as long as shorter; inflorescences mealy puberulent ..... 32. *O. laoshanica*
- 81b. Leaves in subequal pairs or some in unequal pairs, longer ones at most 1.5 × as long as shorter.
- 83a. Stems and leaves abaxially mealy puberulent; corolla lobes dorsally with short hornlike appendages ..... 18. *O. filibracteolata*
- 83b. Stems and leaves abaxially glabrous to variously pubescent with slender trichomes; corolla lobes dorsally smooth to winged and/or with short hornlike appendages.
- 84a. Leaves elliptic to elliptic-oblong, 6–20 × 1.5–7 cm, at least some leaves longer than measurements in alternate lead, with 9–15 pairs of secondary veins, generally becoming yellowed or brownish yellow when dry ..... 7. *O. cantonensis*
- 84b. Leaves elliptic to lanceolate or ovate, 1–11 × 0.7–4 cm, at least some leaves smaller than measurements in alternate lead, with 4–13 pairs of secondary veins, generally drying with green, gray, blackish, or purplish cast.

- 85a. Stigmas ovate to elliptic or lanceolate; widespread, common ..... 28. *O. japonica*  
 85b. Stigmas linear; known only from Yunnan, rare ..... 51. *O. petrophila*

**1. *Ophiorrhiza alata*** Craib, Pl. Siam. Enum. 2: 61. 1932.

有翅蛇根草 you chi she gen cao

Herbs, ascending, to 1 m tall; stems drying compressed, glabrous or puberulent. Leaves in subequal pairs; petiole 1–3 cm, subglabrous; blade drying submembranous, grayish green adaxially, pale abaxially, ovate, elliptic, or lanceolate-ovate, 7–13 × 3–5.5 cm, glabrous on both surfaces, base subcuneate and sometimes shortly decurrent, margins undulate, apex subacuminate; secondary veins 8–10 pairs; stipules caducous, not seen. Inflorescence many flowered, pubescent; peduncle 1.5–5 cm; axes helicoid, usually shorter than 1 cm; bracts reduced or absent. Flowers distylous, with pedicels ca. 2.5 mm. Calyx pubescent; hypanthium portion turbinate-campanulate, ca. 1.8 mm, 5-ribbed; lobes subtriangular, ca. 0.7 mm. Corolla white, tubular with swollen base, subglabrous outside; tube ca. 12 mm, with white villous ring in throat; lobes triangular to broadly ovate, ca. 1.5 mm, dorsally winged and with short horn at apex. Capsules ca. 2.5 × 6 mm. Fl. Apr–May.

Dense forests; 500–700 m. Yunnan [Thailand].

H. S. Lo (in FRPS 71(1): 173. 1999) described this species as distylous but described only an apparently short-styled flower.

**2. *Ophiorrhiza alatiflora*** H. S. Lo, Bull. Bot. Res., Harbin 10(2): 62. 1990.

延翅蛇根草 yan chi she gen cao

Herbs or subshrubs, suberect; stems stout, terete to slightly compressed. Leaves in subequal pairs; petiole 1–1.5(–4) cm, pilosulous; blade drying papery to thickly papery, black adaxially, pale brown abaxially, ovate or oblong-ovate, 5–13 × 2–7 cm, glabrous on both surfaces or hirtellous along principal veins abaxially, base cuneate, rather inequilateral, margins subentire, apex shortly acuminate or subacute; secondary veins 7–12 pairs; stipules caducous, not seen. Inflorescence congested-cymose, many flowered, densely pubescent; peduncle 1–4 cm; axes 0.5–4 cm, helicoid; bracteoles narrowly lanceolate, 7–12 mm, acute, glabrous or sparsely ciliate. Flowers distylous, subsessile. Calyx densely pilosulous to puberulent; hypanthium turbinate, ca. 1.5 mm, 5-ribbed; lobes subtriangular or triangular, 0.5–0.7 mm, with 1 globose gland in each sinus. Corolla white striped with purple, subtubular or slightly swollen at base, outside glabrous and winged along entire length, inside with a ring of pubescence just below throat and/or in throat and onto lobes; tube 12–15 mm; lobes subovate, 2–3 mm, dorsally with wing 0.8–1 mm wide, apex rostrate. Capsules mitriform, ca. 3 × 10 mm, pilosulous.

• Forests. Yunnan.

The protologue described both of the floral forms in detail, noting explicitly that the corollas are similar and the anthers and stigmas reciprocally placed, near the middle of the corolla tube and at or just below the throat, respectively. However, the protologue figure shows partially different patterns of internal corolla pubescence in the two floral forms, with the pubescence restricted to a narrow ring well below the throat in the long-styled flowers but located in the throat of the short-styled flowers.

The varieties treated by H. S. Lo in FRPS (71(1): 160. 1999) are treated here for reference. The protologue figure was not fully labeled but apparently illustrated only var. *alatiflora*; these same figures were reproduced in FRPS (p. 161, t. 41, f. 1–8) where they were explicitly labeled as var. *alatiflora*.

- 1a. Leaf blade drying with thinner texture, glabrous on both surfaces ..... 2a. var. *alatiflora*  
 1b. Leaf blade drying with thicker texture, crisped pubescent along principal veins abaxially ..... 2b. var. *trichoneura*

**2a. *Ophiorrhiza alatiflora* var. *alatiflora***

延翅蛇根草(原变种) yan chi she gen cao (yuan bian zhong)

Leaf blade drying with thinner texture, glabrous on both surfaces.

• Forests. Yunnan.

**2b. *Ophiorrhiza alatiflora* var. *trichoneura*** H. S. Lo, Bull. Bot. Res., Harbin 10(2): 63. 1990.

毛脉蛇根草 mao mai she gen cao

Leaf blade drying with thicker texture, crisped pubescent along principal veins abaxially.

• Forests. Yunnan.

**3. *Ophiorrhiza aureolina*** H. S. Lo, Bull. Bot. Res., Harbin 10(2): 34. 1990.

金黄蛇根草 jin huang she gen cao

Herbs, ascending or sometimes weak at base, to 30(–45) cm tall; stems terete to compressed, usually striate, densely golden yellow pubescent. Leaves in subequal pairs; petiole 0.5–1.5 cm, densely golden yellow pubescent; blade drying papery, yellow or grayish yellow, ovate, lanceolate, or elliptic-oblong, 1.5–6 × 0.8–2 cm, adaxially sparsely strigose or glabrescent to pubescent, abaxially golden yellow pubescent to glabrescent at least on principal veins, base cuneate to acute, apex acute or shortly acuminate; secondary veins 7–10 pairs; stipules persistent on upper nodes, deeply 2-parted, lobes triangular, 3–8 mm, filiform or acuminate at apex. Inflorescences cymose to somewhat congested-cymose, many flowered, golden yellow pubescent; peduncle 5–15 mm; axes short to well developed, helicoid; bracts none or reduced and caducous. Flowers distylous, subsessile. Calyx densely golden yellow hispidulous or -pilosulous; hypanthium turbinate, 1.2–1.5 mm, 5-ribbed; lobes subtriangular, 0.5–0.7 mm. Corolla pale yellow, white, or sometimes reddish, tubular to often somewhat inflated, hispidulous outside; tube 3–4 mm, inside with a white villous ring in upper half; lobes subovate, 1–1.3 mm, apex incurved-rostrate, dorsally smooth. Capsules obcordate, ca. 2 × 4–5.5 mm, hirtellous to pilosulous. Fl. Jul.

• Forests; ca. 1800 m. Yunnan (Xishuangbanna).

H. S. Lo (loc. cit.: 34–37) recognized two forms of this species, f. *aureolina* and f. *qiongyaensis* H. S. Lo; the latter form was formally synonymized with *Ophiorrhiza pumila* by Duan and Lin (Acta Phyto-

tax. Sin. 45: 878. 2007), who are followed here. Lo described the long-styled and short-styled forms as similar in their corollas but differing in the anthers (situated below the middle of the corolla tube in the long-styled form vs. in the throat in the short-styled form); the stigmas appear to be reciprocal in position with the anthers.

**4. *Ophiorrhiza austroyunnanensis*** H. S. Lo, Bull. Bot. Res., Harbin 10(2): 30. 1990 [*"astroyunnanensis"*].

滇南蛇根草 dian nan she gen cao

Herbs, generally procumbent; stems pilosulous or tomentose. Leaves in equal to somewhat unequal pairs; petiole 0.5–1.5 cm, densely pilosulous or tomentose; blade drying thinly papery, usually grayish with veins brown abaxially, ovate, elliptic, elliptic-oblong, or lanceolate, 2–5(–7) × 0.8–2.2 cm, adaxially sparsely pilose, multicellular pilose along principal veins abaxially, base cuneate to subrounded, margins sometimes undulate, apex obtuse; secondary veins 7–9 pairs; stipules persistent, ovate, 5–7 mm, glabrescent, ciliate, long acuminate. Inflorescences congested-cymose to subcapitate, several flowered, glabrescent; peduncles 2–3 cm; bracts elliptic-oblong, 5–6 × 1.5–2 mm, obtuse. Flowers distylous, subsessile. Calyx glabrous; hypanthium subturbinate, 0.8–1 mm, 5-ribbed; lobes triangular, ca. 0.4 mm. Corolla tubular-salverform, outside glabrous; tube ca. 2.6 mm, with white villous ring in throat; lobes subtriangular, ca. 1.3 mm, dorsally smooth, obtuse. Infructescences with axes expanded, lax. Capsules oblate-ellipsoid, ca. 1.5 × 3.5 mm, glabrous, shortly white striate. Fl. May.

• Thickets; ca. 1500 m. Yunnan.

The protologue figure, reprinted in FRPS (71(1): 133, t. 32, f. 1–10. 1999), shows a remarkable dimorphism in the shape and internal pubescence of the corollas (salverform and densely barbate in the throat in the long-styled form vs. funnelliform and glabrous internally in the short-styled form), but the protologue description said only that the corollas of both forms are similar; thus, this figure may deserve re-checking.

**5. *Ophiorrhiza brevidentata*** H. S. Lo, Bull. Bot. Res., Harbin 10(2): 32. 1990.

短齿蛇根草 duan chi she gen cao

Herbs, ascending; stems drying purplish red or purplish brown, slender, terete, densely hirtellous. Leaves in markedly unequal pairs; petiole ca. 1 cm, pilosulous; blade drying papery, ovate, larger ones 2–6 cm, smaller ones 1/3–1/2 as large, strigose adaxially, villous abaxially at least along principal veins, base rounded to obtuse, apex cuspidate; secondary veins 9–11(–15) pairs; stipules lanceolate, 5–6 mm, villous, acuminate. Inflorescences congested-cymose to subcapitate, few to many flowered, densely pilosulous; peduncle 1.5–4.5 cm; axes helicoid; bracts oblong-lanceolate or elliptic-oblong, 5–7 mm, ciliate. Flowers with biology unknown. Calyx pilosulous; hypanthium ca. 1.2 mm; lobes subtriangular, 0.7–0.9 mm. Corolla pink or purplish red, tubular, outside glabrous or in bud puberulent at apex; tube ca. 11 mm, inside villous above middle and in throat; lobes ca. 1.5 mm, dorsally with very short horn. Capsule ca. 2 × 6 mm, puberulent. Fl. Apr–May, fr. Jun.

• Streamsides in forests. Yunnan.

The flowers described in the protologue resemble the short-styled form of distylous species, with the anthers shortly exerted in the throat

and the stigmas positioned near the base of the corolla tube.

**6. *Ophiorrhiza cana*** H. S. Lo, Bull. Bot. Res., Harbin 10(2): 20. 1990.

灰叶蛇根草 hui ye she gen cao

Herbs, creeping; stems drying compressed, striate or shallowly sulcate, pilosulous. Leaves in subequal pairs; petiole 1–1.5 cm, pilosulous; blade drying thinly papery or membranous-papery, leaden gray or sometimes green adaxially, pale and punctulate abaxially, ovate, elliptic-oblong, or lanceolate, 3.5–11 × 1.8–4.5 cm, adaxially subglabrous or sparsely puberulent, abaxially pilosulous along principal veins, base cuneate to rarely subrounded, margins flat or undulate, apex acute or obtuse then acuminate; secondary veins 10–15 pairs; stipules persistent, broadly triangular then abruptly contracted, 4–5 mm, caudate-acuminate. Inflorescences congested-cymose, many flowered, densely pilosulous, branched to 1 order; peduncle shorter than 1 cm; axes very short, helicoid; bracteoles quickly caducous, ca. 0.3 mm. Flowers distylous, subsessile or with pedicels to 1 mm. Calyx with hypanthium subglobose to subturbinate, ca. 1.1 × 1.5 mm, 5-ribbed, hispidulous; lobes linear, 1.4–1.6 mm, with line of stiff hairs. Corolla drying orange-yellow, tubular-funnel-form, hirtellous outside; tube ca. 5 mm, with villous ring in throat; lobes subovate, ca. 2 mm, acute, dorsally with horn ca. 1.5 mm. Capsules obcordate, ca. 2 × 5 mm, hispidulous.

• SE Yunnan.

The protologue described both the long-styled and short-styled forms in detail, noting that the forms have similar calyces and corollas but differ in their stamen and stigma position (i.e., stamens inserted in the corolla tube ca. 0.5 mm from the base and stigmas positioned in the throat in the long-styled form vs. stamens inserted in the throat and stigmas positioned just below the throat in the short-styled flowers). The protologue also noted that this species is known only from the type, which lacks locality or date.

**7. *Ophiorrhiza cantonensis*** Hance, Ann. Sci. Nat., Bot., sér. 4, 18: 222. 1862.

广州蛇根草 guang zhou she gen cao

*Ophiorrhiza bodinieri* H. Léveillé; *O. japonica* Blume var. *leiocarpa* Handel-Mazzetti; *O. longzhouensis* H. S. Lo; *O. paniculiformis* H. S. Lo; *O. seguinii* H. Léveillé; *O. violaceo-flammea* H. Léveillé; *O. yingtakensis* Masamune.

Herbs or subshrubs, weak to erect, to 1.2 m tall, often brown to yellowish brown when dry; stems glabrous to densely puberulent or villosulous. Leaves in subequal pairs; petiole 1–4 cm, glabrous to densely puberulent or villosulous; blade drying papery to thickly papery, grayish brown or grayish green adaxially, pale green to yellowish brown abaxially, oblong-elliptic, elliptic, ovate, ovate-oblong, or lanceolate-oblong, 6–20 × 1.5–7 cm, glabrous throughout or sometimes puberulent abaxially, base obtuse to acute, margins entire, apex acute to acuminate; secondary veins 7–15(to 18, *O. paniculiformis*) pairs; stipules broadly triangular, 0.8–1.5 mm, puberulent to glabrous, caducous. Inflorescences paniculiform to corymbose, several to many flowered, densely puberulent to pilosulous; peduncles 1.5–7 cm; axes helicoid; bracts linear, 1–6 mm. Flowers distylous, subsessile or pedicels to 2 mm. Calyx densely puberulent;

hypanthium subglobose to turbinate, 1–1.3 mm, smooth to weakly 5-ribbed; lobes triangular, 0.4–1 mm, sometimes with 1 gland in each sinus. Corolla white to pink, often drying yellow or pale red, subtubular to tubular-funnelform, slightly swollen at base, puberulent to glabrous outside, inside villous near middle of tube and scaly pubescent above middle and onto lobes; tube 9–12(–15) mm; lobes triangular, 1.8–3(–4) mm, dorsally with wing ca. 0.3 mm wide and often prolonged near apex, apex rostrate. Capsules mitriform, 3–4 × 6–9 mm, densely puberulent to subglabrous. Fl. winter and spring, fr. spring and summer.

- Ravines and watersides in forests; 100–1700 m. Guangdong, Guangxi, Guizhou, Hainan, Sichuan (Pingshan), Yunnan.

*Ophiorrhiza longzhouensis* was synonymized formally by Duan and Lin (Acta Phytotax. Sin. 45: 870. 2007) with *O. cantonensis*; H. S. Lo's separation of *O. longzhouensis* (Bull. Bot. Res., Harbin 10(2): 79. 1990) seems to have been based on its having relatively small leaves. Duan and Lin also synonymized *O. paniculiformis* with *O. cantonensis*. In FRPS (71(1): 165–166. 1999), H. S. Lo described this species as distylous with the corollas of both forms apparently similar and the reciprocally placed anthers and stigmas positioned near the middle of the corolla tube and in its throat, respectively; Lo also described the dried color of specimens of this species as ranging to reddish or red, but those specimens here belong to the more broadly circumscribed *O. succirubra*.

**8. *Ophiorrhiza carnosicaulis*** H. S. Lo, Bull. Bot. Res., Harbin 10(2): 60. 1990.

肉茎蛇根草 rou jing she gen cao

Herbs, apparently ascending; stems stout, subglabrous. Leaves in subequal pairs; petiole 1.5–7 cm, subglabrous; blade drying thickly papery, brownish yellow with veins dark brown abaxially, broadly ovate or broadly elliptic, 11–16 × 5.5–10 cm, glabrous on both surfaces, base subrounded, decurrent, ± inequilateral, margins entire, apex cuspidate; secondary veins 7 or 8 pairs; stipules caducous, not seen. Inflorescence slightly sparse, many flowered, pubescent; peduncle ca. 3 cm; axes helicoid, 2–3 cm; bracteoles subulate-ensiform, 2–3 mm, costate, obtuse. Flowers distylous, subsessile. Calyx pilosulous; hypanthium turbinate, 1.5–2 mm, 10-ribbed; lobes triangular, 0.6–0.7 mm, usually with 1 gland in each sinus. Corolla pale purple, subtubular, glabrous outside; tube ca. 14 mm, pilose in basal portion inside; lobes ovate-triangular, ca. 2 mm, dorsally with very short horn, apex rostrate. Capsules dark purple, mitriform, ca. 5 × 12 mm, pilosulous. Fl. Jun–Jul.

- Wet places in forests. Yunnan (Hekou).

The protologue described the flowers as distylous but noted that long-styled flowers had not been seen; the putative short-styled flowers were described as having the anthers positioned just below the throat and the stigmas in the lower part of the corolla tube. The protologue figure was reproduced but not exactly by FRPS (71(1): 159, t. 40, f. 1–6. 1999); in particular, the protologue figure shows the calyx as pilosulous and the corollas as pilose internally in the basal portion, but the FRPS figure depicts the calyx and the corollas as glabrous.

**9. *Ophiorrhiza chinensis*** H. S. Lo, Bull. Bot. Res., Harbin 10(2): 70. 1990.

中华蛇根草 zhong hua she gen cao

Herbs or subshrubs, to 40(–80) cm tall; stems drying straw-yellow or purplish black, terete, subglabrous to pilosulous. Leaves in subequal pairs; petiole 1–4 cm; blade drying papery, rather pale red, lanceolate to ovate, 3.5–12(–15) cm, usually glabrous or subglabrous on both surfaces, base cuneate, obtuse, or rarely rounded, margins entire, apex acuminate; secondary veins 9 or 10 pairs; stipules caducous, not seen. Inflorescences paniculiform to cymose, several to many flowered, densely hirtellous to pilosulous; peduncle 1.5–3.5 cm; axes 1–3.5 cm, helicoid, deflexed, later becoming erect; bracteoles absent or reduced and caducous. Flowers distylous, on pedicels 1–2 mm. Calyx mealy puberulent; hypanthium subturbinate, 1.2–1.4 mm, 5-ribbed; lobes subtriangular, 0.4–0.5 mm. Corolla white or pale purplish red, tubular-funnelform, subglabrous or mealy puberulent outside, inside pilosulous to scaly hairy in upper part onto lobes and with a white villous ring near middle of tube; tube 18–20 mm; lobes triangular-ovate, 2.5–3 mm, dorsally with carinate narrow wing prolonged into very short horn near apex, apex cucullate-rostrate. Infructescence axes often becoming thickened, glabrescent, expanded, peduncle to 5 cm, axes to 6 cm, pedicels to 4 mm. Capsules obcordate-mitriform, 3–3.4 × 8–10 mm, subglabrous. Fl. winter and spring, fr. spring and summer.

- Fertile soil in broad-leaved forests; ca. 1300 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hubei, Hunan, Jiangxi, Sichuan.

The protologue detailed the long-styled and short-styled flowers, which are said to be similar in corolla size and to differ reciprocally in anther and stigma position, with one structure held in the middle of the corolla tube and the other exerted from the throat, respectively.

**10. *Ophiorrhiza chingii*** H. S. Lo in S. Y. Jin & Y. L. Chen, Cat. Type Spec. Herb. China (Suppl.), 189. 1999.

秦氏蛇根草 qin shi she gen cao

Herbs, weak; stems elongated, drying brownish red, glabrous or puberulent. Leaves in markedly unequal pairs; petiole 0.5–3 cm, puberulent; blade drying thinly papery, straw-yellow except usually purple on midrib, lanceolate-oblong to elliptic, larger ones 3.5–9.5 × 1.3–2.7 cm, smaller ones 1.5–6.5 × 0.7–1.8 cm, subglabrous on both surfaces or sparsely strigose or pilose adaxially and puberulent along principal veins abaxially, base cuneate, margins subentire, apex caudate-acuminate; secondary veins 8 or 9 pairs; stipules caducous, not seen. Inflorescence congested-cymose, few flowered, puberulent to pilosulous; peduncle 1–1.5 cm; axes reduced or 2 or 3, helicoid, ca. 1 cm; bracteoles linear, 3.5–4 mm, obtuse. Flowers distylous, subsessile. Calyx puberulent or pilosulous to glabrescent; hypanthium turbinate, ca. 1.2 mm, 5-ribbed; lobes subovate or sublanceolate, ca. 0.5 mm. Corolla white, tubular-funnelform, subglabrous outside, inside with white villous ring near middle and sometimes scaly villosulous in upper part and onto lobes; tube ca. 9 mm; lobes elliptic-oblong, ca. 3 mm, dorsally with wing ca. 0.5 mm wide, apex subrostrate. Capsules not seen. Fl. Apr.

- Wet places in forests. Yunnan (Yangbi).

Although the original description (H. S. Lo, Bull. Bot. Res., Harbin 10(2): 65. 1990, not validly published) reported that the long-styled flowers were not found, the figure in FRPS (72(1): 161, t. 41, f. 9–13.

1999) illustrated these. That figure shows the corollas as similar in size between the two forms but with the internal pubescence restricted to the upper middle part of the tube in the short-styled form and from the middle of the tube through the top of the lobes in the long-styled form; also, the anthers and stigmas are reciprocally positioned near or just below the middle of the corolla tube and in the throat, respectively.

**11. *Ophiorrhiza cordata*** W. L. Sha ex S. Y. Jin & Y. L. Chen, Cat. Type Spec. Herb. China (Suppl.), 189. 1999.

心叶蛇根草 xin ye she gen cao

Herbs, procumbent to creeping; stems densely brown villous with multicellular trichomes. Leaves in subequal pairs; petiole 0.8–1.7 cm, densely brownish red villous; blade drying papery, adaxially grayish black, abaxially brownish, broadly ovate to suborbicular, 3.5–6 × 2.3–4 cm, subglabrous or sparsely pilose adaxially, villous abaxially along principal veins, base cordate, margins sparsely ciliate, apex obtuse then abruptly shortly acute; secondary veins 5–7 pairs; stipules caducous, not seen. Inflorescence congested-cymose, 4–8-flowered, brownish red villous; peduncle ca. 1 cm; axes reduced; bracts elliptic-oblong, 3.5–6 mm, ciliate. Flowers with breeding biology unknown, subsessile. Calyx subglabrous; hypanthium turbinate, ca. 2 mm, 10-ribbed; lobes triangular, ca. 0.5 mm, obtuse or perhaps acute. Corolla white, tubular-funnelform, glabrous outside; tube 11–12 mm, inside glabrous except with villous ring at middle; lobes triangular, ca. 2.2 mm, dorsally narrowly winged and with very short horn, apex rostrate. Capsules unknown. Fl. Apr.

- Forests. Guangxi (Napo).

Neither the original description (H. S. Lo, Bull. Bot. Res., Harbin 10(2): 55. 1990, not validly published) nor FRPS (71(1): 154–156. 1999) described the floral biology of this species; the flowers described resemble the long-styled form of distylous species, with the anthers positioned near the middle of the corolla tube and the stigmas in the corolla throat.

**12. *Ophiorrhiza crassifolia*** H. S. Lo, Bull. Bot. Res., Harbin 10(2): 47. 1990.

厚叶蛇根草 hou ye she gen cao

Herbs, perhaps ascending, notably fleshy, to 30 cm tall; stems flattened to terete, drying brown, puberulent to glabrous. Petiole 0.5–3.5 cm; leaf blade drying thickly papery, purplish red or yellowish brown abaxially, broadly ovate or broadly elliptic, 5–12 × 3.5–7 cm, glabrous on both surfaces, abaxially densely minutely orbicular scaly, base obtuse, subrounded, or subcordate, usually oblique, margins entire, apex obtuse to shortly cuspidate; secondary veins 5 or 6 pairs; stipules caducous, not seen. Inflorescences cymose or congested-cymose, many flowered, puberulent; peduncle 2.5–5.5 cm; axes short, helicoid; bracteoles narrowly spatulate, 5–5.5 mm, obtuse. Flowers with biology unknown, with pedicels 2–3 mm. Calyx puberulent; hypanthium turbinate, ca. 2 mm, 10-ribbed; lobes subtriangular, ca. 0.6 mm, in sinus with 1 gland. Corolla purplish red, salverform-funnelform, glabrous outside; tube 24–25 mm, pilose inside; lobes ovate-triangular, ca. 2.2 mm, dorsally ridged with very short horn. Capsules rhomboid, ca. 5 × 15 mm, glabrous or subglabrous. Fl. Oct.

- Rocks in forests. Guangxi (Longzhou).

**13. *Ophiorrhiza densa*** H. S. Lo, Bull. Bot. Res., Harbin 10(2): 57. 1990.

密脉蛇根草 mi mai she gen cao

Herbs or subshrubs, ascending, to 1 m tall; stems terete, drying brownish purple, brown pilosulous to glabrescent. Leaves in subequal pairs; petiole 1–3 cm or longer, densely pilosulous or tomentose; blade drying thinly papery, adaxially black, abaxially pale purple, ovate or lanceolate-ovate, usually inequilateral, (5–)8–15(–18) × 1.5–4 cm, sparsely pilosulous adaxially, crisped tomentose along veins abaxially, base subcuneate, margins entire, apex caudate; secondary veins 13–18(–23) pairs; stipules caducous, not seen. Inflorescence 4–8 cm, many flowered, brown tomentose; axes helicoid; bracteoles linear, ca. 3 mm. Flowers distylous, sessile to subsessile. Calyx hispidulous; hypanthium turbinate to subglobose, ca. 1.2 mm, 5-ribbed; lobes narrowly triangular, ca. 1 mm. Corolla pale purple, subtubular to inflated, densely pilosulous outside, inside pilosulous near middle of tube and sometimes onto lobes, and/or densely glandular-pilose on lobes; tube ca. 10 mm; lobes subdeltoide, ca. 1.5 mm, dorsally with very short horn, apex rostrate. Capsules unknown. Fl. Nov.

- Dense forests; 1400–1600 m. Yunnan (Malipo).

In the protologue and FRPS (71(1): 158. 1999), H. S. Lo described the floral forms as having similar corollas and reciprocally placed anthers and stigmas near the middle of the corolla tube and shortly exerted, respectively. However, the protologue figure showed differences between the floral forms in the internal pubescence of the corollas, with the pubescence confined to the general area of the middle of the tube in the short-styled flowers but distributed from the middle of the tube to the tops of the lobes in the long-styled form; this internal corolla pubescence was not described in the protologue text. The insides of the corolla lobes were described as “*glanduloso-piloso*” in the protologue text, which is unusual and also not shown in one of the protologue figures of the corolla interior.

**14. *Ophiorrhiza dulongensis*** H. S. Lo, Bull. Bot. Res., Harbin 10(2): 27. 1990.

独龙蛇根草 du long she gen cao

Herbs, weak to procumbent; stems drying purplish brown, pilosulous. Petiole 0.3–1 cm, densely pilosulous or villosulous; leaf blade drying membranous to papery, often green with veins purplish brown abaxially, broadly ovate or ovate, 1–4 × 0.6–2.5 cm, scattered scabrous-strigillose adaxially, abaxially moderately pilose along principal veins, base obtuse to rounded, apex acute; secondary veins 4–6 pairs; stipules persistent, subulate, 4–6 mm, glabrous. Inflorescence fasciculate, 3- or 4-flowered, glabrescent; peduncle ca. 1 cm or slightly longer; bracts linear, ca. 1 mm. Flowers distylous. Calyx puberulent to glabrescent; hypanthium 1–1.5 mm, 5-ribbed; lobes narrowly lanceolate or lanceolate, 1.5–2 mm. Corolla white, funnelform, subglabrous outside; tube 7–7.5 mm, densely villous in throat; lobes triangular-ovate, 2.5–3 mm, dorsally ribbed at least in bud. Capsules unknown. Fl. Jul.

- Evergreen broad-leaved forests; 2300–2400 m. NW Yunnan.

In the protologue and FRPS (71(1): 127. 1999), H. S. Lo detailed the floral forms, noting that their corollas are similar in size and the an-

thers and stigmas are reciprocally placed near the middle of the corolla tube and in its throat, respectively.

**15. *Ophiorrhiza ensiformis*** H. S. Lo, Bull. Bot. Res., Harbin 10(2): 22. 1990.

剑齿蛇根草 jian chi she gen cao

Herbs, ascending; stems pilosulous at least when young. Leaves in subequal pairs; petiole 1–3 cm, pilose; blade drying submembranous, brown or dark brown, elliptic, ovate, or elliptic-oblong, 5–12 × 2.5–5.5 cm, adaxially sparsely ferruginous pilosulous, abaxially glabrous or subglabrous, base obtuse then narrowed to decurrent, margins entire, apex acute to rather abruptly acuminate; secondary veins 10–12 pairs; stipules generally persistent, broadly triangular then abruptly narrowed, 3–5 mm, glabrescent, ciliate, long acuminate. Inflorescences congested-cymose, several to many flowered, ferruginous pilosulous; peduncle ca. 1.5 cm; axes rather short, helicoid; bracts linear-ensiform to narrowly spatulate, 5–7 mm, glabrescent, pinnately veined, ciliate, acute. Flowers with biology unknown, with short pedicels. Calyx with hypanthium subturbinate, ca. 1.5 × 2.5 mm, 5-ribbed, with dense ferruginous long trichomes mixed with unicellular trichomes; lobes linear-ensiform to spatulate, 5–7.5 mm, pinnately veined, glabrescent except ciliate, acute. Corolla white, tubular-funnelform, outside 5-ribbed or 5-ridged in upper portion, glabrous or sparsely hispidulous along ribs; tube 13–14 mm, inside with white villous ring in throat; lobes triangular, 2–2.5 mm, dorsally narrowly winged, obtuse, rostrate. Capsules rhomboid-pyramidal, ca. 4 × 8 mm, pilosulous. Fl. Jan.

• Streamsides; ca. 2000 m. Yunnan (Longling).

**16. *Ophiorrhiza fangdingii*** H. S. Lo in S. Y. Jin & Y. L. Chen, Cat. Type Spec. Herb. China (Suppl.), 190. 1999.

方鼎蛇根草 fang ding she gen cao

Herbs, weak at base, ascending above, to 40 cm tall; stems subterete, drying brown, subglabrous. Leaves in unequal pairs; petiole 0.5–2 cm, glabrous; blade drying papery, adaxially leaden gray, abaxially pale with veins brown, oblong-ovate or oblong-lanceolate, larger ones 5–7.5 cm, smaller ones 2–5 cm, glabrous on both surfaces, base subcuneate and somewhat inequilateral, margins subentire, apex obtuse then acuminate; secondary veins 5–10 pairs; stipules caducous, not seen. Inflorescences 4- or 5-flowered; peduncle ca. 1 cm; axes short, helicoid; bracteoles linear or narrowly lanceolate, 10–18 × 1.5–4 mm, obtuse, costate. Flowers reportedly distylous, with short pedicels. Calyx glabrous; hypanthium turbinate, ca. 1.2 mm, 5-ribbed; lobes linear-lanceolate, ± unequal, 2–3 mm, obtuse. Corolla white, funnelform, glabrous outside; tube ca. 23 mm, white villous above middle inside; lobes dorsally narrowly winged, wing extending into very short horn. Capsules not seen. Fl. Jan.

• Wet places in forests on limestone; ca. 1200 m. Guangxi (Napo).

In the original description (Bull. Bot. Res., Harbin 10(2): 40, 42. 1990, not validly published) and FRPS (71(1): 144. 1999), H. S. Lo described this species as distylous but described only the putative long-styled flowers; these resemble the long-styled form of distylous species

in having the stigmas exerted and the anthers positioned below them in the upper part of the corolla tube.

**17. *Ophiorrhiza fasciculata*** D. Don, Prodr. Fl. Nepal. 136. 1825.

簇花蛇根草 cu hua she gen cao

Herbs or subshrubs, erect, to 0.5(–2) m tall; stems pilosulous or puberulent to glabrescent. Leaves in subequal pairs; petiole 1–1.5[–5] cm, puberulent; blade drying papery, sometimes darkened adaxially, pale abaxially, elliptic to lanceolate-elliptic, 8–12[–16] × 3–6 cm, glabrous or sparsely strigillose adaxially, abaxially puberulent on veins, base obtuse to cuneate then attenuate, apex acute to caudate-acuminate; secondary veins 10–13 pairs; stipules narrowly triangular, 4–10 mm, puberulent to glabrescent. Inflorescences congested-cymose to subfasciculate, several flowered, densely pilosulous; peduncle 1–8 cm; branched portion 1–2 cm; bracts ligulate-lanceolate, 6–12 mm, persistent. Flowers with biology unknown, subsessile. Calyx densely puberulent to hirtellous; hypanthium compressed cylindrical, 1–1.5 mm; lobes ovate to deltoid, 1–1.2 mm. Corolla white sometimes flushed with pink, drying yellowed, tubular-funnelform, outside puberulent; tube 10–15 mm, inside glabrous; lobes ovate-oblong, 1.5–2.5 mm. Capsules compressed rhombic, 1.5–4.5 × 4–10.5 mm, puberulent or hirtellous. Fr. Aug.

Broad-leaved forests; ca. 1700 m. Xizang (Mêdog) [Bhutan, India, Myanmar, Nepal].

Measurements in brackets are taken from the description of this species by Deb and Mondal (Bull. Bot. Surv. India 39(1–4): 44–47. 1997) and may be expected in Chinese plants.

**18. *Ophiorrhiza filibracteolata*** H. S. Lo in S. Y. Jin & Y. L. Chen, Cat. Type Spec. Herb. China (Suppl.), 190. 1999.

大桥蛇根草 da qiao she gen cao

Herbs, apparently ascending, to 30 cm tall; stems mealy puberulent. Leaves in subequal pairs; petiole 1–5 cm; blade drying papery, dark brown, ovate to broadly ovate, 2.5–5.5 × 1.5–3.3 cm, glabrous, base obtuse or subrounded, margins entire, apex acute; secondary veins 7 or 8 pairs; stipules caducous, not seen. Inflorescence somewhat congested-cymose, many flowered; peduncle ca. 3 cm; axes up to 1 cm, helicoid; bracteoles filiform, fleshy, 2.5–3 mm. Flowers distylous, subsessile or pedicels to 2 mm. Calyx pilosulous; hypanthium subturbinate, ca. 1.4 mm, shallowly 5-ribbed; lobes triangular to narrowly lanceolate, ca. 0.7 mm, with 1 gland in each sinus. Corolla white, tubular-funnelform, outside pilosulous, inside with white villous ring at middle and scaly pilose from middle onto lobes; tubes 11–12 mm; lobes ovate-triangular, ca. 3 mm, dorsally narrowly winged and with very short horn. Capsules not seen. Fl. Apr.

• Forests. Guangdong (Ruyuan).

The original description (H. S. Lo, Bull. Bot. Res., Harbin 10(2): 52–53. 1990, not validly published) described the flowers as distylous with the short-styled flowers as unknown; the putative long-styled flowers were described as having the anthers positioned just below the middle of the corolla tube and the stigmas in the throat. In FRPS (71(1): 153. 1999), H. S. Lo gave the plant height as 20 cm, but the original

description said 30 cm. Much of the information on pubescence details here is taken from the figure in the original description.

**19. *Ophiorrhiza gracilis*** Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 41: 311. 1872.

纤弱蛇根草 xian ruo she gen cao

Herbs, weak at base, suberect above, to 30 cm tall; stems glabrous. Petiole glabrous; leaf blade drying membranous-papery, grayish on both surfaces, paler abaxially, lanceolate or subovate, 6–12(–17) × 2–4.5 cm, glabrous on both surfaces, base cuneate to attenuate and usually oblique, apex caudate to long acuminate; secondary veins 8–12 pairs; stipules caducous, not seen. Inflorescences many flowered, puberulent; peduncle 2–3 cm; bracteoles subulate, 0.5–1.2 mm, early caducous. Flowers distylous, subsessile. Calyx with hypanthium turbinate, ca. 1.3 mm, 5-ribbed; lobes ovate-triangular, 0.4–0.5 mm. Corolla white or reddish at apex, tubular; tube ca. 10.5 mm, white villous in throat and at middle inside; lobes triangular-ovate, 1.2–1.3 mm, dorsally with horn 0.8–1 mm. Capsules not seen. Fl. spring.

Dense forests. Yunnan [Myanmar].

H. S. Lo (in FRPS 71(1): 171. 1999) described the anthers as situated near the base of the corolla tube and the stigmas positioned just below the throat in the long-styled form vs. the anthers situated above the middle of the corolla tube and the stigmas near the base in the short-styled form.

**20. *Ophiorrhiza grandibracteolata*** F. C. How ex H. S. Lo, Bull. Bot. Res., Harbin 10(2): 43. 1990.

大苞蛇根草 da bao she gen cao

Herbs or subshrubs, weak at base, ascending above, to 70 cm tall; stems subterete, densely villous with trichomes multicellular or sometimes also unicellular. Leaves in unequal pairs; petiole 0.5–2(–3) cm, stout, densely multicellular villous; blade drying thinly papery, gray-black adaxially, reddish or pale abaxially, ovate, broadly ovate, or lanceolate-ovate, larger ones 4–12(–15) × 2–4.5(–6) cm, smaller ones 2–4(–6) × 1.2–2.5 cm, both surfaces glabrescent or multicellular villous on principal veins, base obtuse to cuneate and sometimes shortly decurrent, apex acute; secondary veins 7–10 pairs; stipules caducous, not seen. Inflorescence congested-umbelliform-cymose to subcapitate, 5- to many flowered or rarely 1-flowered, densely multicellular villous; peduncle ca. 0.8 cm; axes reduced; bracts and bracteoles ovate to lanceolate, 10–15 mm, pinnately veined, glabrescent except multicellular ciliate along margin and on dorsal costa. Flowers distylous, subsessile or on stout pedicels to 2 mm. Calyx multicellular villous; hypanthium broadly turbinate, 2–2.3 mm; lobes triangular, 1–1.2 mm. Corolla white or reddened, drying purplish red, funnellform, outside with 5 strigose lines from middle of tube to apices of lobes; tube 22–25 mm, inside with white villous ring above middle; lobes subovate, ca. 5 mm, sometimes weakly reticulate-veined, dorsally narrowly winged. Capsules rhomboid, 4–4.5 × ca. 11 mm, villous. Fl. Nov.

• Wet places in forests; 1200–1500 m. Guangxi (Napo), Yunnan.

The protologue and H. S. Lo in FRPS (71(1): 146. 1999) described this species as distylous, with the anthers borne well above the

middle of the corolla tube and the stigmas positioned in the throat in one floral form vs. the anthers positioned near the middle of the corolla tube and the stigmas well exerted in the other.

**21. *Ophiorrhiza hainanensis*** Y. C. Tseng, Fl. Hainan. 3: 582. 1974.

海南蛇根草 hai nan she gen cao

Herbs, weak to erect, to 50 cm tall; stems viscous puberulent with unicellular trichomes, to glabrescent. Leaves in subequal pairs; petiole 1–2.5 cm, puberulent; blade drying thinly papery, green on both surfaces, elliptic to ovate, 6–13 × 2.5–5 cm, adaxially glabrous, abaxially pilosulous along principal veins, base obtuse to acute, margins entire, apex shortly acuminate; secondary veins 15–17 pairs; stipules deciduous, triangular, 3–5 mm, aristate-acuminate. Inflorescence congested-cymose, several flowered, viscous puberulent; peduncles 0.5–1 mm, stout; bracts elliptic-oblong, 5–6 mm, viscid ciliate. Flowers with biology unknown. Calyx in bud sparsely puberulent; hypanthium to 2 mm; lobes triangular, to ca. 1 mm. Corolla in bud tubular. Capsules turbinate, ca. 4 × 9 mm, sparsely puberulent. Fl. (bud) and fr. Dec.

• Dense forests, uncommon. Hainan (Baoting, Qiongzong).

*Ophiorrhiza hainanensis* was synonymized with *O. nutans* by Duan and Lin (Acta Phytotax. Sin. 45: 877. 2007). However, this species is here recognized provisionally, based on the distinctions given in the key to species.

**22. *Ophiorrhiza hayatana*** Ohwi, Repert. Spec. Nov. Regni Veg. 36: 57. 1934.

瘤果蛇根草 liu guo she gen cao

*Ophiorrhiza stenophylla* Hayata, Icon. Pl. Formosan. 2: 91. Oct 1912, not Valetton (Feb 1912).

Herbs, erect, to 50 cm tall; stems subterete or weakly 4-angled, glabrous to puberulent or strigillose. Leaves in subequal pairs; petiole 0.3–1.5(–2) cm, glabrous to puberulent; blade drying papery, discolorous, narrowly elliptic-oblong, elliptic, or lanceolate, 2–10(–15) × 0.8–2.5(–3) cm, glabrous on both surfaces or often hispidulous near margins adaxially, base acute to attenuate, apex acute to acuminate; secondary veins 4–8 pairs; stipules deciduous, broadly triangular to rounded, 0.5–1 mm, puberulent to glabrescent and/or glandular, sometimes erose. Inflorescence several to many flowered, cymose, densely puberulent to pilosulous sometimes in lines, fasciculate or peduncle 1.5–2(–4) cm; axes subcapitate to helicoid; bracteoles linear to narrowly triangular, 0.5–4 mm, glabrous, persistent or deciduous as fruit develop. Flowers with biology unknown, subsessile or on pedicels to 1.5 mm, sometimes tuberculate. Calyx glabrous to puberulent; hypanthium suburceolate to oblate, ca. 1.2(–2) mm, densely tuberculate with peglike structures on lower part and also sometimes on sides, 5-ribbed; lobes linear to spatulate, 1–1.3 mm. Corolla white, slenderly funnellform, outside glabrous; tube (12–)13–15 mm, inside barbate in throat; lobes triangular, 2.5–3(–4) mm, ciliate, dorsally winged and with very short horn near apex. Capsules obovate, ca. 4 × 8–10 mm, tuberculate and sometimes pilosulous.

• Broad-leaved forests; 500–900 m. Taiwan.

Some measurements given by H. S. Lo in FRPS (71(1): 129. 1999) have not been seen on specimens and are provisionally presented in parentheses. The floral biology of this species has not been described; the specimens seen appear to be monomorphic with the anthers positioned at or just below the corolla throat and the stigmas perhaps positioned at the same level.

**23. *Ophiorrhiza hispida*** J. D. Hooker, Fl. Brit. India 3: 83. 1880.

尖叶蛇根草 jian ye she gen cao

Herbs, ascending, to 1 m tall; stems moderately villous or hispid. Leaves in subequal pairs; petiole 1.5–4(–7) cm, densely pilose or hispid; blade drying thinly papery, gray or olive-green, ovate or broadly ovate, 7–17 × 3.5–7 cm, sparsely hispid on both surfaces or moderately so abaxially, base obtuse, decurrent, often oblique, margins subentire, apex acuminate; secondary veins 9–14 pairs; stipules sublanceolate, markedly contracted above, pilose, ciliate, acuminate. Inflorescence congested-cymose, many flowered, villous; peduncle 1.5–2 cm; bracts linear, 3–4 mm, ciliate, persistent. Flowers distylous, subsessile. Calyx pilose; hypanthium subturbinate, ca. 1 mm, 5-ribbed; lobes subtriangular, ca. 0.5 mm, usually with 1 gland in each sinus. Corolla pale purple or white, slenderly tubular, sparsely pilose or hispid outside; tube 10–12 mm, inside with white villous ring near middle; lobes ovate-triangular, ca. 1 mm. Capsules ca. 2 × 5 mm, pilose or hispid.

Forests. SW Yunnan [NE India].

H. S. Lo (in FRPS 71(1): 134. 1999) noted that the corollas of the two floral forms are similar but that the flowers differ in the reciprocally placed anthers and stigmas positioned near the middle of the corolla tube or in the throat, respectively.

This species is circumscribed here following H. S. Lo (loc. cit.) and does not correspond to the circumscription of this species by Deb and Mondal (Bull. Bot. Surv. India 39(1–4): 59–61. 1997). Deb and Mondal described *Ophiorrhiza hispida* as having corollas with tubes 3–4 mm, leaves 2–15 × 1–4 cm, a plant stature of 35 cm or less, and calyx lobes 0.8–1 mm; the plants treated as *O. hispida* by Lo key to *O. fasciculata* in Deb and Mondal's treatment.

**24. *Ophiorrhiza hispidula*** Wallich ex G. Don, Gen. Hist. 3: 523. 1834.

版纳蛇根草 ban na she gen cao

Herbs, procumbent at base, ascending above, to 15 cm tall; stems glabrescent to densely villosulous. Leaves in subequal pairs; petiole 0.3–1 cm, puberulent to glabrescent; blade drying thinly papery, grayish, ovate, broadly ovate, elliptic, or sublanceolate, 1.5–4.5(–7) × 1–2.5 cm, adaxially glabrescent to sparsely strigillose, abaxially glabrous except pilosulous to puberulent along principal veins, base cuneate to obtuse, margins entire, apex acute; secondary veins 5–7 pairs; stipules persistent on uppermost nodes, triangular becoming strongly narrowed, 4–10 mm, glabrescent, long acuminate to aristate. Inflorescences cymose, several flowered, puberulent to hispidulous; peduncle 1–2.5(–4) cm; axes developed, helicoid; bracts few, narrowly triangular to linear, 0.5–2 mm. Flowers subsessile. Calyx puberulent to pilosulous; hypanthium ellipsoid to subglobose, ca. 1 mm; lobes narrowly triangular, 0.8–1 mm. Corolla white, tubular, outside puberulent; tube 4–5 mm, barbate in

throat and glabrescent to puberulent inside tube; lobes triangular-ovate, ca. 1.5 mm. Capsules obcordate, 1.5–2.5 × 4–5 mm, puberulent to villosulous. Fl. May–Sep, fr. Jul–Oct.

Dense forests. Yunnan (Xishuangbanna) [Bangladesh, India (including Andaman Islands), Indonesia, Malaysia, Thailand].

*Ophiorrhiza hispidula* was synonymized by Deb and Mondal (Bull. Bot. Surv. India 39(1–4): 131–133. 1997) under *O. trichocarpa* Blume, without explanation and reportedly without having seen Blume's type; the name *O. hispidula* is provisionally used here pending further study.

**25. *Ophiorrhiza howii*** H. S. Lo, Bull. Bot. Res., Harbin 18: 277. 1998.

宽昭蛇根草 kuan zhao she gen cao

*Ophiorrhiza longiflora* F. C. How ex H. S. Lo, Bull. Bot. Res., Harbin 10(2): 70. 1990, not Blume (1826).

Herbs, ascending, to ca. 1 m tall; stems terete to somewhat flattened, rather stout, drying purplish brown to black, subglabrous. Leaves in subequal pairs; petiole 1–2 cm, densely pilosulous; blade narrowly ovate, narrowly elliptic, or ovate, 5–9 × 2–3 cm, abaxially usually pilosulous along principal veins, base cuneate, apex acuminate; secondary veins 8–13 pairs; stipules caducous, unknown. Inflorescence cymose, several to many flowered, densely pilosulous; peduncles 1.5–2 cm; axes short, helicoid; bracts absent or minute and caducous. Flowers with biology unknown, on pedicels 1–2 mm. Calyx with hypanthium portion subturbinate and slightly compressed, ca. 1.7 × 2.3 mm, 5-ribbed, mealy puberulent; lobes sublanceolate, ca. 0.5 mm, subglabrous. Corolla white, salverform, puberulent outside; tube 22–24 mm, pilose or glabrous inside; lobes broadly ovate, 3–4 mm, dorsally with horn 1.5–2 mm, apex incurved rostrate. Capsules not seen. Fl. Oct.

• Forests; 1100–1500 m. Yunnan (Maguan).

The protologue described the corolla tubes as pilose inside, but the protologue figure showed the corolla tube to be glabrous inside.

**26. *Ophiorrhiza huanjiangensis*** D. Fang & Z. M. Xie, Acta Phytotax. Sin. 40: 155. 2002.

环江蛇根草 huan jiang she gen cao

Herbs, procumbent to creeping; stems to 23 cm, densely to moderately hirtellous or pilosulous, to sometimes glabrescent. Leaves in subequal pairs; petiole 0.15–1 cm, hirtellous; blade drying papery, ovate to elliptic-ovate, 0.5–1.85 × 0.3–1.2 cm, both surfaces puberulent at least on principal veins to glabrescent, base obtuse to cordulate, apex obtuse to acute; secondary veins 3 or 4 pairs; stipules caducous, not seen. Inflorescence cymose to umbelliform, 1–3-flowered, hirtellous to glabrescent; peduncle and/or pedicel 5–10 mm; bracts linear, 1–2 mm, sparsely puberulent to glabrescent. Flowers apparently distylous, pedunculate or pedicellate. Calyx puberulent to glabrous; hypanthium turbinate, 1–1.5 mm; lobes ovate to narrowly triangular, ca. 1 mm. Corolla white, funnelliform, outside glabrous; tube 10–12 mm, puberulent inside; lobes ovate, 4–5 mm. Capsules unknown. Fl. Apr.

• Dense forests in valleys; ca. 400 m. Hunan (Huitong).

The protologue described the flowers as distylous and reported that only the short-styled form has been seen.

**27. *Ophiorrhiza hunanica*** H. S. Lo, Bull. Bot. Res., Harbin 10(2): 24. 1990.

湖南蛇根草 hu nan she gen cao

Herbs, procumbent at base, to 15 cm tall; stems drying black, subglabrous. Leaves in unequal pairs; petiole 1–3 cm, subglabrous; blade drying papery, purple on veins, obovate or ovate, 6–18 × 3–6.5 cm, adaxially sparsely hirtellous-strigose, abaxially subglabrous or villous on veins, base cuneate, apex obtuse to subacute; secondary veins 10–14 pairs; stipules often persistent, ovate, 6–8 mm, ciliate, acuminate. Inflorescence cymose, many flowered, densely villous, pendulous; peduncle ca. 3 cm, arching; principal axes 2 or 3 pairs, helicoid; bracts linear, 8–15 × 1–1.4 mm, sparsely pinnately veined, sparsely ciliate. Flowers with biology unknown, subsessile. Calyx with hypanthium compressed turbinate, ca. 2 mm, 5-ribbed, densely multicellular villous; lobes linear, 6–7 mm, hispidulous along costa. Corolla in bud with color unknown, 5-winged, wings ciliate. Capsules unknown. Fl. Nov.

- Dense forests in valleys; ca. 400 m. Hunan (Huitong).

In the protologue the anthers and stigmas of the flower buds were described, but these immature structures are not reliable indicators of the size or arrangement of the mature structures.

**28. *Ophiorrhiza japonica*** Blume, Bijdr. 978. 1826–1827.

日本蛇根草 ri ben she gen cao

*Ophiorrhiza acutiloba* Hayata; *O. cavaleriei* H. Léveillé; *O. eryei* Champion; *O. dimorphantha* Hayata; *O. dimorphantha* f. *brevistigma* Hayata; *O. dimorphantha* f. *longistigma* Hayata; *O. japonica* var. *acutiloba* (Hayata) Ohwi; *O. japonica* var. *minor* J. Krause; *O. labordei* H. Léveillé; *O. monticola* Hayata; *O. monticola* f. *brevistigma* Hayata; *O. monticola* f. *longistigma* Hayata; *O. nigricans* H. S. Lo.

Herbs, weak to ascending, to 60 cm tall, often drying flushed with purple or darkened; stems subterete to slightly compressed, glabrous or with 2 hirtellous or pilosulous lines. Leaves in subequal pairs; petiole 0.3–2(–3) cm, glabrous to hirtellous or puberulent; blade drying papery, ovate, elliptic-ovate, elliptic, elliptic-oblong, lanceolate, or narrowly lanceolate, 1–11 × 0.7–3.5 cm, glabrous to strigillose or hispidulous adaxially, glabrous to puberulent, hirtellous, or villosulous abaxially, base cuneate to obtuse, margins flat to crisped, apex acute to acuminate or rarely obtuse (to rounded, *Ophiorrhiza nigricans*); secondary veins 4–8 pairs; stipules triangular, 0.8–2 mm, glabrescent, acute to bifid, caducous sometimes leaving 1 to several thickened scars to 0.3 mm. Inflorescence congested-cymose to cymose, few to many flowered, puberulent to strigillose, pilosulous, or hirtellous; peduncle 0.5–5 cm (to 6 cm, *O. nigricans*); axes congested-cymose becoming helicoid; bracts lanceolate-linear, spatulate, or linear, 1–6 mm, sometimes glabrescent, persistent. Flowers distylous, on pedicels 1–2 mm. Calyx glabrous to densely puberulent or pilosulous; hypanthium subturbinate to obovate or subglobose, 0.8–1 mm, 5-

ribbed; lobes triangular, 0.4–1.2 mm. Corolla white or pink, funnellform to tubular-funnelform, outside glabrous to puberulent or pilosulous and longitudinally winged, inside pilose near middle and pilosulous above middle through throat and sometimes onto lobes; tube 9–14 mm; lobes triangular to ovate, (1.5–1.8 mm, *O. nigricans*) 2.5–4 mm, dorsally with wing to 0.5 mm wide, apex rostrate. Capsules submitriform, 2.5–4 × 6.5–9 mm, pilosulous to glabrous. Fl. winter, fr. spring and summer.

Fertile soil of ravines in forests; 100–2400 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hubei, Hunan, Jiangxi, S Shanxi?, Sichuan, Taiwan, NE Yunnan, Zhejiang [Japan, Vietnam].

Duan and Lin (Acta Phytotax. Sin. 45: 873. 2007) synonymized *Ophiorrhiza nigricans* with *O. japonica*. They also synonymized *O. kwangsiensis* with *O. japonica*, but that species is provisionally separated here based on the characters given in the key to species pending further study. The reproductive biology of *O. japonica* was studied by Nakamura et al. (J. Plant Res. 120: 501–509. 2007), who found the Chinese plants sampled to be distylous and diploid. The corollas are apparently similar between the two floral forms, with the reciprocally placed anthers and stigmas positioned near the middle of the corolla tube vs. at or just above its throat, respectively.

**29. *Ophiorrhiza kuroiwae*** Makino, Bot. Mag. (Tokyo) 20: 5. 1906 [“*Kuroiwai*”].

小花蛇根草 xiao hua she gen cao

*Ophiorrhiza japonica* Blume var. *kuroiwae* (Makino) Ohwi; *O. kotoensis* Hatusima; *O. liukuensis* Hayata; *O. parviflora* Hayata (1912), not Reinwardt ex Korthals (1851).

Herbs, erect, to 60 cm tall; stem 4-angled, densely strigillose-tomentulose to glabrescent. Leaves in subequal pairs; petiole 0.5–2.3(–3) cm, villosulous-tomentulose to glabrescent; blade drying membranous to papery, red or pale, oblong-ovate, ovate, or elliptic-oblong, 5–12(–15) × 2–6 cm, adaxially sparsely scaberulous, abaxially puberulent at least on principal veins, base cuneate to obtuse then often narrowed and shortly attenuate, margins entire, apex acute or occasionally obtuse or shortly acuminate; secondary veins 6–11 pairs; stipules deciduous, deeply 2-parted, 3–7 mm, puberulent, lobes cuspidate or filiform. Inflorescences cymose to paniculate, several to many flowered, hirtellous- or hispidulous-tomentulose; peduncle 3.5–5 cm; axes several, elongating as buds develop, helicoid; bracts reduced, caducous. Flowers with biology unknown, subsessile or on pedicels to 2 mm. Calyx puberulent to glabrous; hypanthium subglobose, 1–1.5 mm; lobes triangular, 0.3–0.5 mm, dorsally keeled. Corolla white, tubular or inflated, outside glabrous to puberulent, inside pubescent in upper part of tube and onto lobes; tube 2.5–3.5 mm; lobes ovate-triangular, ca. 1 mm, dorsally ridged. Capsules reniform-oblate, 2–3.5 × 6–9 mm, 5-ribbed, glabrescent. Fl. Apr–Oct, fr. Sep–Feb.

Taiwan [Japan, Philippines].

**30. *Ophiorrhiza kwangsiensis*** Merrill ex H. L. Li, J. Arnold Arbor. 24: 453. 1943.

广西蛇根草 guang xi she gen cao

Herbs, creeping to weakly ascending, to 18 cm tall; stems drying yellowish brown, subglabrous or with puberulent to

strigillose lines. Leaves in subequal pairs; petiole 0.5–1.5 cm, glabrous; blade drying papery to membranous, leaden gray or olive-green adaxially, pale green or yellowed abaxially, cordiform to cordate-ovate, 0.8–2 × 0.7–1.5 cm, glabrous on both surfaces or puberulent adaxially, base cordate to subtruncate, margins entire, apex acute to somewhat obtuse; secondary veins 4–6 pairs; stipules caducous, not seen. Inflorescence congested-cymose, few or several flowered, densely hirtellous to pilosulous; peduncle 0.7–1.5 cm; axes reduced or shortly helicoid; bracts linear to linear-lanceolate, 4.5–6 mm, glabrous except sparsely ciliolate. Flowers reportedly distylous, subsessile, fragrant. Calyx puberulent; hypanthium turbinate, ca. 1 mm, weakly 5-ribbed; lobes oblong-lanceolate, in bud 1–2.5 mm and equal to unequal. Corolla pale yellow or reddish, tubular-funnelform, outside subglabrous; tube 9–10 mm, inside sparsely pilose; lobes ovate-triangular, ca. 2 mm, dorsally costate and with very short horn. Capsules ?mitriform, 2–2.5 × 6–7 mm, puberulent. Fl. early spring or Sep.

- Shady wet places in forests. Guangxi (Shangsi).

H. S. Lo (in FRPS 71(1): 145. 1999) reported this species as distylous but described only one floral form, similar to the short-styled flowers of distylous species. The protologue described only young flower buds with no description of anther or stigma position. The protologue described the calyx lobes as ca. 1 mm without any note about them being unequal, while H. S. Lo (loc. cit.) described these as 1.5–2.2 mm and usually unequal; both conditions are included here provisionally.

*Ophiorrhiza kwangsiensis* was synonymized with *O. japonica* by Duan and Lin (Acta Phytotax. Sin. 45: 873. 2007), but a number of characters seem to distinguish it; it is provisionally separated here pending further study.

**31. *Ophiorrhiza laevifolia*** H. S. Lo, Bull. Bot. Res., Harbin 10(2): 80. 1990.

平滑蛇根草 ping hua she gen cao

Herbs, suberect, to 80 cm tall; stems subterete to slightly compressed, drying black on upper part, puberulent or subglabrous. Leaves in subequal pairs; petiole 0.5(–1.5) cm; blade drying papery, adaxially dark green, abaxially pale green, ovate or lanceolate, ± inequilateral, 4–12 × 2–4.5 cm, glabrous on both surfaces, base cuneate, margins undulate or flat, apex acute, acuminate, or caudate; secondary veins 5 or 6 pairs; stipules caducous, not seen. Inflorescence congested-cymose, many flowered, densely ferruginous hirtellous; peduncle reduced or up to 1 cm; axes reduced to shortly helicoid; bracts absent or minute. Flowers reportedly distylous, subsessile. Calyx glabrescent; hypanthium obovoid, ca. 2 mm, 5-ribbed; lobes narrowly lanceolate, ca. 1 mm, with 1 gland in each sinus. Corolla pink, subtubular, glabrous outside; tube ca. 13 mm, sparsely white villous above middle inside; lobes subovate, 1.8–2 mm, dorsally with short horn 0.1–0.2 mm, apex rostrate. Capsules not seen. Fl. Apr.

- Semi-evergreen forests; 800–1000 m. Xizang (Médog).

The protologue reported this species as distylous but described only one floral form, similar to the short-styled flowers of distylous species; this was described as having the stigmas positioned not far below the middle of the corolla tube and the anthers exerted.

**32. *Ophiorrhiza laoshanica*** H. S. Lo, Bull. Bot. Res., Harbin 10(2): 65. 1990.

老山蛇根草 lao shan she gen cao

Herbs, suberect, to 50 cm tall; stems sulcate to subterete, drying grayish yellow, subglabrous. Leaves in markedly unequal pairs; petiole 0.3–1 cm, subglabrous; blade drying thinly papery, adaxially gray to blackened, abaxially grayish yellow, ovate, larger ones 6–8(–11) × 2–3 cm, smaller ones 1.5–5 × 1–2 cm, glabrous on both surfaces, base obtuse to acute then decurrent, apex shortly acuminate; secondary veins 6–9 pairs; stipules caducous, not seen. Inflorescence ferruginous mealy puberulent; peduncle 1–2 cm; axes short, helicoid; bracteoles filiform-subulate, ca. 3 mm. Flowers reportedly distylous, subsessile. Calyx mealy puberulent; hypanthium obconic-turbinate, ca. 1 mm, 5-ribbed; lobes triangular to deltoid, ca. 0.4 mm. Corolla white, tubular-funnelform, outside glabrous; tube 9–10 mm, inside near middle with villous fascicles mixed with scale-like pilose trichomes; lobes subovate, ca. 0.7 mm, dorsally with a broad semiorbicular wing. Capsules not seen. Fl. Nov–Jun of following year.

- Wet places in forests. Guangxi.

The protologue reported this species as distylous but described only one floral form, similar to the short-styled flowers of distylous species with the anthers positioned in or shortly above the corolla throat and the stigmas situated near the middle of the corolla tube.

**33. *Ophiorrhiza liangkwangensis*** H. S. Lo, Bull. Bot. Res., Harbin 10(2): 39. 1990.

两广蛇根草 liang guang she gen cao

Herbs, procumbent to creeping, rooting at nodes, to 30 cm tall; stems densely white- or pale yellow villous. Leaves usually in unequal pairs; petiole 0.5–2(–3) cm, densely hirtellous or villosulous; blade drying thinly papery or submembranous, broadly ovate, ovate, or oblong-ovate, 1.5–8(–11) × 1–6 cm, sparsely hirtellous to villous on both surfaces, base subrounded to obtuse, usually inequilateral, apex acute to obtuse; secondary veins 6–11 pairs; stipules caducous, not seen. Inflorescence congested-cymose, 2- or 3(–6)-flowered, densely villosulous to villous; peduncle 0.5–1.2 cm; bracts linear or filiform, 1.5–10 mm. Flowers distylous, subsessile or on pedicels to 3 mm. Calyx villosulous; hypanthium subglobose, ca. 1.5 mm; lobes filiform, ca. 2 mm, with 1 globose gland in each sinus. Corolla white or pale purple, drying yellow, slenderly funnelform, sparsely villous to glabrescent outside; tube 18–20 mm, sparsely pilose inside in basal 1/3; lobes ovate-triangular, ca. 6 mm, dorsally ribbed, apex rostrate. Capsules mitriform, ca. 3 × 7 mm, densely villous. Fl. Jun.

- Roadsides at forest margins. Guangdong (Xinyi), Guangxi.

The protologue detailed both long-styled and short-styled flowers and noted that their calyces and corollas are similar. H. S. Lo in FRPS (71(1): 142. 1999) described this species as rarely many flowered, but this has not been noted by other authors nor seen on specimens studied.

**34. *Ophiorrhiza lignosa*** Merrill, Brittonia 4: 176. 1941.

木茎蛇根草 mu jing she gen cao

Subshrubs, erect, to 50 cm tall; stems weakly 4-angled to terete, glabrous except with 2 pilosulous to hirtellous lines. Leaves in subequal pairs; petiole 0.6–2 cm, glabrous or villosulous; blade drying papery or submembranous, adaxially olive-green, pale abaxially, lanceolate or narrowly lanceolate, 5–11 × 1–2 cm, glabrous on both surfaces or sometimes pilosulous along principal veins abaxially, base long cuneate, margins entire, apex acuminate; secondary veins 8 or 9 pairs; stipules caducous, not seen. Inflorescence cymose to somewhat congested-cymose, many flowered, 3–4.5 cm, subferruginous pilosulous; peduncle 1–2 cm; axes helicoid, up to 1 cm; bracteoles ensiform-linear or linear and acuminate, 1.5–3 mm. Flowers with biology unknown, sessile or on pedicels to 1 mm. Calyx hispidulous; hypanthium compressed turbinate, ca. 1.3 mm, 5-ribbed; lobes ovate-triangular, 0.5–0.7 mm, usually with 1 gland in each sinus. Corolla purple, subtubular, glabrous outside, inside with white villous ring in upper part of tube and onto lobes; tube 10–11 mm; lobes broadly ovate or oblong-ovate, ca. 3 mm. Capsules unknown. Fl. Apr.

Forests; ca. 1100 m. Yunnan (Malipo) [Myanmar].

The protologue reported this species only from Myanmar, at ca. 1200 m, and did not detail the position of the anthers but did describe the style as long enough to position the stigmas in the corolla throat; H. S. Lo (in FRPS 71(1): 152–153, t. 37, f. 4. 1999) described and illustrated the anthers as positioned near the middle of the corolla tube. Thus, the flowers described resemble the long-styled flowers of distylous species; none of these authors have posited the floral biology of this species.

### 35. *Ophiorrhiza longicornis* H. S. Lo, *sp. nov.*

长角蛇根草 chang jiao she gen cao

Type: China. Guangxi: Napo, *Y. Lin 3-5324* (holotype, GXMI).

Validating Latin description: that of “*Ophiorrhiza longicornis* Lo” (H. S. Lo, Bull. Bot. Res., Harbin 10(2): 57. 1990).

Herbs, apparently ascending; stems drying brownish red, terete, glabrous. Leaves in somewhat unequal pairs; petiole 1–2 cm, glabrous; blade drying papery or rather thickly papery, abaxially yellowish or greenish yellow with veins brown, narrowly elliptic-ovate to oblanceolate, 4–10 × 1.5–3.5 cm, glabrous on both surfaces, base cuneate, margins entire, apex obtuse then cuspidate or caudate; secondary veins 7–11 pairs; stipules caducous, not seen. Inflorescences cymose to subcorymbose, many flowered, branched to several orders, puberulent; peduncles 1.5–2.5 cm; axes spiciform to helicoid, principal ones ca. 1 cm; bracteoles turning purple when dry, linear-lanceolate, 3–5 mm, sharply acute. Flowers with biology unknown, sessile. Calyx with hypanthium compressed subglobose-turbinate, ca. 1.5 mm, 5- or 10-ribbed, puberulent; lobes triangular, 0.7–1 mm, subglabrous, with 1 gland in each sinus. Corolla purplish red, tubular, glabrous and slenderly 5-ribbed outside; tube ca. 4.5 mm, inside with white villous ring below middle; lobes subtriangular, 0.4–0.5 mm, dorsally with horn 1.5–2 mm and drying black, apex incurved-rostrate. Capsules not seen. Fl. Apr.

• Forests. Guangxi (Napo).

This name was previously published by H. S. Lo (loc. cit.) but not validly so because the type was not indicated in accordance with Art. 37.6 of the *Vienna Code*.

### 36. *Ophiorrhiza longipes* H. S. Lo, Bull. Bot. Res., Harbin 10(2): 49. 1990.

长梗蛇根草 chang geng she gen cao

Herbs, apparently ascending, to 100 cm tall; stems drying flattened, densely pilosulous. Leaves in markedly unequal pairs; petiole 0.5–1(–3) cm, pilosulous; blade drying thinly papery, adaxially grayish green, abaxially pale or purple, ovate or elliptic, larger ones 3.5–7.5 × 2–3.2 cm, smaller ones 2–5 × 1.5–3 cm, glabrous adaxially, abaxially glabrous or pilosulous along veins, base cuneate, obtuse, or subrounded, ± inequilateral, margins subentire, apex obtuse; secondary veins 6–8 pairs; stipules caducous, not seen. Inflorescence cymose, 5–9-flowered, often rather lax, hispidulous to hirsute; peduncle 2–2.5 cm; axes helicoid, ca. 1 cm; bracteoles subulate, 2–3 mm. Flowers with biology unknown, sessile. Calyx pilosulous or hispidulous; hypanthium turbinate, ca. 2.5 mm, 5-ribbed; lobes triangular, 1–1.3 mm, with 1 gland in each sinus. Corolla yellowish white or tinged with purple, funnellform, glabrous outside; tube ca. 16 mm, with pilose or pilosulous ring above middle inside; lobes ovate-triangular, 5–5.5 mm, dorsally thinly winged, apex rostrate. Capsules drying brownish red, mitriform-rhomboid, ca. 3 × 7 mm. Fl. Apr.

• Rocks in wet and shady places in forests. Guangxi.

The figure of this species presented by H. S. Lo in FRPS (71(1): 150, t. 36, f. 1–6. 1999) seems to be redrawn based on the protologue figure but differs a bit from it; in particular, the lower right-hand leaf is shown in FRPS as acute or shortly acuminate, while in the protologue figure this was shown as obtuse and there corresponded to the textual description. Neither the protologue nor FRPS posited the floral biology of this species; the flower described in the protologue resembles the short-styled form of distylous species, with the anthers positioned in or just below the corolla throat and the stigmas positioned just below the middle of the corolla tube.

### 37. *Ophiorrhiza luchuanensis* H. S. Lo, Bull. Bot. Res., Harbin 10(2): 74. 1990.

绿春蛇根草 lü chun she gen cao

Herbs or subshrubs, weak to ascending, to 2 m tall; stems densely hispid. Leaves in markedly unequal pairs; petiole 0.3–2 cm, densely hispid or pilose; blade drying papery, lanceolate to narrowly elliptic, larger ones 5–15 × 2.5–4.5 cm, smaller ones 2–6(–8) × 1–2 cm, strigose adaxially, densely hirtellous or hirsute along principal veins abaxially, base acute to attenuate, apex acuminate to caudate; secondary veins 7–12 pairs, prominent adaxially; stipules caducous. Inflorescence cymose, many flowered, densely villous; peduncle 1–3 cm; axes several, helicoid; bracts absent or minute. Flowers distylous, sessile. Calyx glabrous or ferruginous mealy puberulent; hypanthium rhombic-turbinate, ca. 1 mm, 5-ribbed; lobes subtriangular, ca. 0.4 mm. Corolla white, salverform-tubular and slightly contracted in middle, glabrous outside; tube 7–8 mm, barbate in throat; lobes triangular, 1.8–2 mm, dorsally costate to narrowly winged near apex. Capsules drying reddish brown, broadly mitriform, ca. 1.5 × 5 mm, 5-ribbed, subglabrous. Fl. Oct.

- Shady wet places in forests; ca. 2000 m. S Yunnan (Lüchun).

The protologue described the corollas of both floral forms as similar and noted that the anthers and stigmas are reciprocally placed, at or just below the throat or at the bottom of the corolla tube, respectively. The protologue figure was apparently redrawn for FRPS (71(1): 170, t. 43, f. 1–7. 1999) and differs from the first version: in particular, the stems, petioles, and inflorescence are depicted as densely hispid or pilose in the protologue figure but apparently glabrous in the redrawn figure, and the redrawn figure shows the secund-helicoid flower arrangement on the inflorescence axes as significantly more regular than in the protologue figure.

**38. *Ophiorrhiza lurida*** J. D. Hooker, Fl. Brit. India 3: 82. 1880.

黄褐蛇根草 huang he she gen cao

Herbs, procumbent to ascending, to 20 cm tall; stems puberulent to densely villosulous. Leaves in subequal pairs; petiole (0.1–)0.2–2.8 cm, densely villosulous; blade drying papery, adaxially green, abaxially pale green, ovate, ovate-lanceolate, or elliptic, 0.6–5 × 0.6–2.5 cm, adaxially sparsely hispidulous to hispid, abaxially puberulent or hispid along principal veins, base obtuse, truncate, or subrounded, margins entire, apex obtuse to acute; secondary veins 4 or 5 pairs; stipules generally persistent, triangular to ovate, 2–4 mm, glabrous to hirtellous, acuminate or aristate with 1–3 bristles 2–7 mm. Inflorescences congested-cymose to subcapitate, few to several flowered, glabrous; peduncles 0.5–4 cm; heads ca. 1 × 1 cm; bracts subulate-linear, lanceolate, elliptic-oblong, or spatulate, 3–8 mm, costate, obtuse to acute. Flowers with biology unknown, sessile or on pedicels to 1.5 mm. Calyx glabrous; hypanthium subglobose, ca. 1.5 mm; lobes narrowly triangular, ca. 1 mm. Corolla white, drying yellow, tubular to inflated, glabrous outside, inside villous in upper part of tube and onto lobes; tube 2.5–4.5 mm; lobes triangular-ovate, 1–1.5 mm, dorsally narrowly winged, obtuse. Capsules not seen in China. Fl. Aug.

Broad-leaved forests, *Tsuga* forests; [300–]1800–2300 m. Xizang (Médog), NW Yunnan [India (Darjeeling, Sikkim)].

Deb and Mondal (Bull. Bot. Surv. India 39(1–4): 67. 1997) described the capsules of Indian plants as flattened obturbinate, 1.5–3 × 5–8 mm, and glabrous to puberulent.

**39. *Ophiorrhiza macrantha*** H. S. Lo, Bull. Bot. Res., Harbin 10(2): 28. 1990.

大花蛇根草 da hua she gen cao

Herbs, weak at base, ascending to erect above, to 50 cm tall; stems drying orange, subglabrous or puberulent when young. Leaves in unequal pairs; petiole 1–4 cm, glabrous or puberulent; blade drying thinly papery or papery, adaxially grayish green, pale or yellowish green abaxially, oblong-ovate, subovate, or elliptic-oblong, 4–16 × 1.8–4.5 cm, glabrous on both surfaces or abaxially puberulent along principal veins, base obtuse to subrounded, margins usually undulate, apex caudate; secondary veins 7–9 pairs; stipules generally persistent, narrowly triangular, 6–8 mm, with globose gland at apex and at each side of base. Inflorescences cymose, many flowered, puberulent; peduncle 2–2.5 cm; axes helicoid, 0.5–2 cm; bracteoles linear-spatulate, ca. 2 mm, ciliolate. Flowers distylous, on

pedicels 1.5–3 mm. Calyx puberulent to glabrescent; hypanthium rhomboid-subglobose, ca. 2.5 × 2 mm, 10-ribbed; lobes triangular, subequal or unequal, 1.5–2 mm. Corolla reddish or pink, funnelliform, glabrous outside, inside with sparsely white villous ring at middle of tube and sparsely villous above this and sometimes onto lobes; tube 22–23 mm; lobes subovate, ca. 5.5 mm, dorsally with wing ca. 0.8 mm wide with very short apical spur, apex rostrate. Immature capsules submitriform, ca. 3 × 7–7.5 mm, 10-ribbed. Fl. Mar.

- Streamsides in dense forests; ca. 3000 m. Yunnan.

In the protologue and FRPS (71(1): 129–131. 1999), H. S. Lo noted that the long-styled flowers have the anthers positioned near the middle of the corolla tube and the stigmas in its throat, while the short-styled flowers have the anthers positioned in the throat and the stigmas below them inside the upper part of the corolla tube.

**40. *Ophiorrhiza macrodonta*** H. S. Lo, Bull. Bot. Res., Harbin 10(2): 25. 1990.

大齿蛇根草 da chi she gen cao

Large herbs or subshrubs, erect, to 2.5 m tall; stems drying black to brownish red, ferruginous pilosulous to glabrescent. Leaves in subequal pairs; petiole 1–2 cm or sometimes longer; blade drying papery, adaxially grayish brown, abaxially pale, oblong-elliptic, ovate-oblong, or ovate, 6.5–17 × 2.5–5.5 cm, glabrescent on both surfaces or sparsely pilosulous adaxially and pilosulous along principal veins abaxially, base cuneate then decurrent, margins entire, apex acuminate; secondary veins 14–16 pairs; stipules ovate to lanceolate-ovate, 5–16 mm, entire or occasionally dentate, parallel-nerved, subglabrous, acuminate. Inflorescence cymose to congested-cymose, many flowered, pendulous then becoming erect, densely ferruginous hirsute or -hirtellous; peduncle ca. 1 cm; bracts sublinear, 7–9 mm, ciliolate, glabrous or sparsely pilose, persistent. Flowers reportedly distylous, on pedicels 1–1.5 mm. Calyx hispidulous; hypanthium obrhombic, ca. 1 mm, weakly 5-ribbed; lobes narrowly lanceolate, ca. 2.5 mm. Corolla greenish yellow in bud, reddish at anthesis, tubular-funnelform, glabrous outside; tube 13–14 mm, villous inside; lobes subovate, ca. 2 mm, dorsally with wing to 0.6 mm wide, apex rostrate. Capsules obcordate, 2.5–3 × 7.5–9 mm, hispidulous. Fl. Sep.

- Wet places in forests; ca. 1500 m. Yunnan.

In the protologue and FRPS (71(1): 126–127. 1999), H. S. Lo described the flowers as distylous with the long-styled flowers unknown; the putative short-styled flowers were described as having the anthers partially exerted in the throat and the stigmas situated below the middle of the corolla tube.

**41. *Ophiorrhiza medogensis*** H. Li, Acta Phytotax. Sin. 18: 116. 1980.

长萼蛇根草 chang e she gen cao

Herbs or subshrubs, ascending, to 60 cm tall; stems densely brown villous with multicellular trichomes. Leaves in unequal pairs; petiole 0.5–1.5(–3.5) cm, densely villous; blade drying thinly papery, pallid green on both surfaces or reddened abaxially, lanceolate, oblong-lanceolate, or subovate, 6–14 × 2.2–5.5 cm, adaxially glabrous or sparsely hispid, abaxially

densely villous along principal veins, base rounded or subcordate, usually inequilateral, margins subentire or undulate, ciliate, apex abruptly acuminate; secondary veins 8–16 pairs; stipules generally persistent, with 2 or 3 subulate to filiform lobes ca. 1 cm, ciliate. Inflorescences congested-cymose, many flowered, densely villous; peduncles shorter than 1 cm; axes short, helicoid; bracts filiform or subulate, 1–2 cm, ciliate. Flowers with biology unknown, subsessile. Calyx densely villous; hypanthium subglobose, ca. 2 mm; lobes filiform, 7–8 mm, ciliate. Corolla white, tubular-funnelform, puberulent outside; tube ca. 18 mm, in throat notably expanded, inside villous above middle; lobes oblong-ovate, ca. 4 mm. Capsules obovate, ca. 5 × 10 mm. Fl. Sep.

• Broad-leaved forests on mountain slopes; ca. 1700 m. Xizang (Médog).

**42. *Ophiorrhiza mitchelloides*** (Masamune) H. S. Lo, Bull. Bot. Res., Harbin 18: 277. 1998 [*“mitchelloides”*].

东南蛇根草 dong nan she gen cao

*Hayataella mitchelloides* Masamune, Trans. Nat. Hist. Soc. Formosa 24: 206. 1934 [*“mitchelloides”*]; *Geophila exigua* H. L. Li; *Ophiorrhiza exigua* (H. L. Li) H. S. Lo.

Herbs, procumbent to creeping, generally rooting at most nodes; stems villous with multicellular trichomes. Leaves in subequal to unequal pairs; petiole 0.3–1.3 cm, densely villous to villosulous; blade drying papery, adaxially dark gray or nearly black, abaxially purplish red to reddish or rarely pale, broadly ovate, ovate, or suborbicular, 0.8–2.5 × 0.6–2 cm, sparsely pilose to villous along principal veins to throughout on both surfaces, base subtruncate to obtuse or rounded, apex acute to rounded-obtuse; secondary veins 3–5 pairs; stipules usually caducous, triangular to ligulate, 1–1.5 mm, glabrescent, acuminate to 2–4-lobed. Inflorescences fasciculate to cymose, 1- or 2(or 5)-flowered, villosulous; peduncles and/or pedicels 0.4–2 cm; bracts linear, 4–8 mm. Flowers distylous, pedunculate or pedicellate. Calyx with hypanthium compressed globose, ca. 1.2 mm, densely villosulous; lobes linear, ca. 1.4 mm, glabrescent or ciliate. Corolla white, funnelform or salverform, outside with 5 strigose or hispidulous lines; tube ca. 15 mm, inside with white villous ring just above middle and otherwise villous or glabrous except pubescent in throat; lobes broadly ovate, 5–6.5 mm. Capsules obcordate, ca. 3.5 × 9–10 mm, villous. Fl. Apr, fr. Jun.

• Broad-leaved forests or forest margins; 400–1500 m. Fujian, Guangdong, Hunan, Jiangxi, Taiwan.

This small plant was separated by some authors in a monotypic genus endemic to Taiwan, *Hayataella*. However, recent authors have noted a broader range for it and included it in *Ophiorrhiza* based on morphological (H. S. Lo, Bull. Bot. Res., Harbin 10(2): 1–82. 1990, and references cited therein) and molecular (Nakamura et al., J. Plant Res. 119: 657–661. 2006) characters. H. S. Lo in FRPS (71(1): 141–142. 1999) detailed both short-styled and long-styled flowers.

**43. *Ophiorrhiza mungos*** Linnaeus, Sp. Pl. 1: 150. 1753.

蛇根草 she gen cao

Herbs or subshrubs, ascending, to 100 cm tall; stems glabrescent to puberulent. Leaves in subequal pairs; petiole 1.5–5

cm, glabrous to puberulent; blade drying thinly papery, elliptic or lanceolate-elliptic, 2.5–22 × 1–9 cm, glabrous adaxially, glabrous or puberulent on principal veins abaxially, base cuneate to obtuse, apex acute to acuminate; secondary veins 10–19 pairs; stipules deciduous, narrowly triangular, 4–8 mm, sometimes 2-lobed, glabrescent. Inflorescence cymose to paniculate, several to many flowered, puberulent; peduncle 0.5–6 cm; axes helicoid; bracts reduced and caducous or none. Flowers apparently distylous, subsessile. Calyx densely puberulent; hypanthium compressed turbinate, ca. 1 mm; lobes triangular, 0.5–1 mm. Corolla white, tubular or sometimes constricted near middle, outside puberulent to glabrous; tube 2.5–4 mm, inside villosulous near middle; lobes triangular, ca. 1 mm, dorsally smooth to costate. Capsules broadly mitriform, 1.5–3 × 3–9 mm, glabrous to densely puberulent.

Expected in Yunnan [India, Myanmar, ?Philippines, Thailand to Malaysia, ?Vietnam].

This species was not included for China by H. S. Lo (Bull. Bot. Res., Harbin 10(2): 1–82. 1990; FRPS 71(1): 110–174. 1999) but has been reported from the surrounding regions (Deb & Mondal, Bull. Bot. Surv. India 39(1–4): 67–73. 1997), and some specimens from China have been identified with this name by Chinese botanists (in herb.). The description here is presented at least for reference and is based on that of Deb and Mondal (excluding *Ophiorrhiza mungos* var. *nemorosa* (Thwaites) J. D. Hooker). Deb and Mondal (loc. cit.) reported *O. mungos* to flower and fruit throughout the year and did not describe its floral biology or individual floral forms but illustrated both short-styled and long-styled flowers.

**44. *Ophiorrhiza mycetiifolia*** H. S. Lo, Guihaia 11: 103. 1991.

腺木叶蛇根草 xian mu ye she gen cao

Herbs or subshrubs, erect, to 2.5 m tall; stems puberulent to villosulous. Leaves in generally equal pairs; petiole 2–4 cm, densely villosulous; blade drying thinly papery, olive-green, elliptic-ovate or elliptic, 10–20 × 4–7.5 cm, sometimes weakly bullate, adaxially glabrous or sparsely strigillose to puberulent, abaxially glabrous to densely villosulous, base obtuse to rounded then shortly decurrent, margins entire, apex acute to shortly cuspidate; secondary veins 15 or 16 pairs; stipules caducous, unknown. Inflorescence congested-cymose, many flowered, 5–6 cm wide, densely villosulous-tomentulose; peduncle ca. 2.5 cm; axes several, dichasial at lower axes then helicoid above; bracts linear-lanceolate, 5–10 mm, acuminate. Flowers with biology unknown, subsessile or on pedicels to 2 mm. Calyx densely hirtellous; hypanthium subglobose, ca. 1.5 mm, 5-ribbed with ribs glabrescent; lobes triangular, 0.8–1 mm. Corolla white, tubular, outside glabrous to pilosulous, pubescent throughout inside; tubes 10–11 mm; lobes subtriangular, ca. 2 mm, reflexed, dorsally with horn 1.5–2 mm near apex. Capsules not seen. Fl. Dec.

• Sparse forests in valleys; ca. 600 m. Guangxi (Longzhou).

**45. *Ophiorrhiza nandanica*** H. S. Lo, Bull. Bot. Res., Harbin 10(2): 63. 1990.

南丹蛇根草 nan dan she gen cao

Herbs, suberect, to 40 cm tall; stems drying black to brownish yellow, terete, glabrous. Petiole 1–2.5 cm, glabrous;

leaf blade drying papery, dark gray or blackish gray adaxially, pale yellow or greenish yellow with veins brown abaxially, ovate to lanceolate, 4–11 × 1.5–4.5 cm, glabrous, base obtuse, apex acuminate; secondary veins 5–9 pairs; stipules caducous, not seen. Inflorescences congested, several flowered, pubescence in 2 pilose longitudinal lines; peduncle 1–2 cm; axes helicoid; bracts linear-lanceolate, 3–5 mm, weakly pinnately veined. Flowers distylous, sessile or subsessile. Calyx with hypanthium submitriform, ca. 1.5 mm, 5-ribbed; lobes triangular or narrowly triangular, markedly unequal, 1 or 2 larger ones 1–2 mm, 3 or 4 smaller ones ca. 0.7 mm, both lobes and sinuses glandular. Corolla pale yellow, subsalverform, glabrous outside; tube ca. 18 mm, glabrous inside; lobes long narrowly triangular, ca. 1.5 mm, dorsally with wing ca. 1 mm wide with very short horn at top, apex rostrate. Capsules not seen. Fl. Oct.

- Shady places in forests in limestone regions. Guangxi (Nandan).

In the protologue and FRPS (71(1): 162. 1999), H. S. Lo detailed both long-styled and short-styled flowers, with similar corollas but differing in anther and stigma positions (in the middle of the corolla tube vs. the throat, respectively and correspondingly).

**46. *Ophiorrhiza napoensis*** H. S. Lo, Bull. Bot. Res., Harbin 10(2): 48. 1990.

那坡蛇根草 na po she gen cao

Herbs, ascending, to 30 cm or taller; stems glabrous. Leaves in unequal pairs; petiole 0.3–1.4 cm, glabrous; blade drying papery, grayish adaxially, pale yellow abaxially, narrowly lanceolate to subovate, 5–12 × 1.5–3.5 cm, glabrous on both surfaces or pilosulous along midrib abaxially, base cuneate to obtuse, margins entire, apex acute to acuminate; secondary veins 7–12 pairs; stipules caducous, triangular, 0.5–1 mm, entire or glandular. Inflorescences congested-cymose, several flowered, ferruginous- to golden yellow tomentulose or -pilosulous; peduncle 0.8–1 cm; axes short, helicoid; bracts lanceolate-linear, 10–14 mm, weakly costate, glabrous. Flowers with biology unknown, subsessile or on pedicels to 1.5 mm. Calyx with hypanthium turbinate-rhombic, 1.5–2 × 2.3–2.5 mm, 5-ribbed, densely pilosulous; lobes narrowly triangular, unequal, largest ones 1.8–2 mm, smallest ones 1.3–1.5 mm, glabrous, sinus sometimes with 2 or 3 globose glands. Corolla white, drying orange-yellow, salverform to funnelform, glabrous outside; tube 20–22 mm, glabrous inside; lobes ligulate to ovate, 2.5–5 mm, dorsally ribbed and with very short horn. Immature fruit obovate. Fl. Oct.

- Forests on hill slopes. Guangxi (Napo), Yunnan (Maguan).

**47. *Ophiorrhiza nutans*** C. B. Clarke ex J. D. Hooker, Fl. Brit. India 3: 84. 1880.

垂花蛇根草 chui hua she gen cao

Herbs, weak to erect, to 70 cm tall; stems densely reddish brown villous with multicellular trichomes. Leaves in subequal to unequal pairs; petiole 0.5–2 cm, densely pubescent; blade drying papery, ovate, lanceolate, elliptic, or elliptic-oblong, 3–8(–13) × 1.5–4 cm, sparsely pilose or strigose adaxially, glabrescent except pubescent along principal veins abaxially, base obtuse to subrounded then attenuate, margins ciliolate, entire or undulate, apex acute to cuspidate; secondary veins 9–13[–15]

pairs; stipules persistent, lanceolate or subovate, 8–10 mm, acuminate to 2-lobed. Inflorescence congested-cymose to corymbiform, many flowered, densely hirtellous; peduncle 1–3[–6] cm; bracts linear-oblong or lanceolate, 5–10 mm, ciliate, sometimes fimbriate and/or with a linear lobe at each side. Flowers distylous, subsessile. Calyx densely hispidulous to glabrescent; hypanthium subturbinate, ca. 1.5 mm; lobes sublanceolate, ca. 1.2 mm. Corolla white, tubular-funnelform, glabrous or sparsely hispid outside; tube [6.5–]9[–19] mm, inside sparsely pilosulous near middle and barbate in throat; lobes subtriangular or subovate, 2–3 mm, dorsally narrowly winged. Capsules mitriform, ca. 2.5 × 6–7 mm, hispidulous to subglabrous.

Moist forests; 700–2400 m. Xizang (Médog), Yunnan [NE India, Myanmar, Nepal].

Measurements in brackets are taken from the description of this species by Deb and Mondal (Bull. Bot. Surv. India 39(1–4): 82. 1997) and may be expected in Chinese plants. H. S. Lo (in FRPS 71(1): 131. 1999) and Deb and Mondal noted that this species is distylous, with the corollas similar in size in both floral forms and the stigmas and anthers reciprocally placed in the corolla throat and near the base of the corolla tube, respectively. H. S. Lo described the corolla tubes as ca. 9 mm; the Fl. Bhutan (2(2): 779. 1999) described them as 6.5–8.5 mm; and Deb and Mondal described them as 13–19 mm.

*Ophiorrhiza hainanensis* was synonymized with *O. nutans* by Duan and Lin (Acta Phytotax. Sin. 45: 877. 2007). However, several distinctions between these were cited by H. S. Lo (Bull. Bot. Res., Harbin 10(2): 30. 1990), and these species are provisionally separated here pending further study.

**48. *Ophiorrhiza ochroleuca*** J. D. Hooker, Fl. Brit. India 3: 78. 1880.

黄花蛇根草 huang hua she gen cao

Herbs, annual or perennial, or subshrubs, erect, to 40[–100] cm tall; stems [glabrous to] pubescent. Leaves in subequal pairs; petiole 1–4.5 cm, subglabrous; blade drying thinly papery, adaxially pale green, abaxially paler, elliptic to lanceolate, [3.5–]13–15[–22.5] × [1.5–]4.5–6[–10] cm, subglabrous except pilosulous abaxially along principal veins, base cuneate to obtuse, margins entire, apex shortly acuminate to subacute; secondary veins [8–]10–12[–15] pairs; stipules deciduous, subovate or triangular, [4–]5[–15] mm, at apex with 1 gland. Inflorescence cymose, many flowered, branched to several orders, pilosulous; peduncle ca. 3[–10] cm; axes helicoid, 1–3[–10] cm; bracts minute, caducous. Flowers subsessile or on pedicels to 3 mm. Calyx puberulent to pilosulous; hypanthium subturbinate, ca. 3 mm, 5-ribbed; lobes triangular, ca. 0.5 mm. Corolla yellow to pale yellow, tubular, outside glabrous and 5-ribbed in upper part; tube 5.5–6.5[–12] mm, glabrous inside; lobes ca. 1 mm. Capsules mitriform, ca. 3 × [5–]7.5 mm, puberulent to glabrescent.

Wet places in forests; 300–2000 m. Yunnan [Bhutan, NE India, Myanmar].

Measurements included in brackets are from the description of this species by Deb and Mondal (Bull. Bot. Surv. India 39(1–4): 84–86. 1997). Their description conflicts with that of the Fl. Bhutan (2(2): 777. 1999), which distinguished this species by its leaves glabrous below while Deb and Mondal considered the pubescent lower leaf veins distinctive.

**49. *Ophiorrhiza oppositiflora*** J. D. Hooker, Fl. Brit. India 3: 80. 1880.

对生蛇根草 *dui sheng she gen cao*

Herbs, weak to ascending, to 70 cm tall; stems generally terete, hispidulous to glabrescent. Leaves in subequal pairs; petiole 1–2 cm, subglabrous or puberulent; blade drying papery, brown, narrowly elliptic, ovate, or lanceolate, [3–]8–15 × [1–]3.5–6 cm, subglabrous or sparsely strigillose adaxially, pilose along principal veins abaxially, base cuneate then narrowed and shortly decurrent, apex shortly acuminate; secondary veins 9–11(–15) pairs; stipules caducous or persistent on upper nodes, linear or bifid, 2–11 mm, puberulent. Inflorescence terminal and/or paired in upper stem nodes, cymose to paniculate, many flowered, ferruginous puberulent; peduncle 2–4 cm; axes helicoid; bracts minute, caducous. Flowers with biology unknown, subsessile. Calyx pubescent; hypanthium ellipsoid, ca. 1 mm; lobes triangular, ca. 0.3 mm. Corolla white, tubular-funnelform, outside glabrous; tube ca. 4[–8] mm, inside glabrous or densely barbate in throat; lobes oblong-triangular, ca. 2 mm, dorsally ridged, apex rostrate. Capsules drying yellow, mitriform-obcordate, ca. 2 × 6–7 mm, subglabrous. Fl. winter and spring.

Wet places in forests; [below 100–1500 m in Myanmar]. Hainan, Yunnan [NE India, Myanmar].

Deb and Mondal (Bull. Bot. Surv. India 39(1–4): 86–87. 1997) described this species as annual and the flowers as variously glabrous inside or densely barbate in the throat. Measurements in brackets above are taken from their description and may be expected in Chinese plants.

**50. *Ophiorrhiza pauciflora*** J. D. Hooker, Fl. Brit. India 3: 84. 1880.

少花蛇根草 *shao hua she gen cao*

Herbs, weak to erect, to 30 cm tall; stems pilosulous to villosulous. Leaves in subequal pairs; petiole 0.5–2 cm, hirtellous; blade drying thinly papery, adaxially dark purple, abaxially purple or grayish, ovate to elliptic-ovate, 1.5–5.5 × 0.8–2.5 cm, adaxially strigose or sericeous, abaxially pubescent on principal veins, base obtuse to subrounded or sometimes shortly decurrent, apex obtuse; secondary veins 5–9 pairs; stipules persistent, narrowly triangular or usually 2-lobed, 3–6 mm, lobes narrowly triangular to linear, glabrescent. Inflorescence congested-cymose, several flowered, pubescent; peduncle 1–3 cm; bracts linear, 3–6.5 mm, persistent. Flowers distylous, subsessile. Calyx puberulent to pilosulous or glabrescent; hypanthium obovoid, ca. 1.5 mm; lobes sublanceolate, 0.8–1 mm. Corolla white, tubular, outside hispid to glabrescent; tube 8–9 mm, barbate in throat and upper part; lobes ovate, ca. 1 mm. Capsules obcordate, ca. 2 × 4.5 mm, puberulent to hirtellous or glabrescent. Fl. and fr. May–Oct.

Dense forests; 600–1600 m. Yunnan (Xishuangbanna) [NE India].

Deb and Mondal (Bull. Bot. Surv. India 39(1–4): 89–93. 1997) recognized two varieties, the pubescent var. *pauciflora* with corollas 6–9 mm and the glabrous var. *glabra* Deb and Mondal with corollas 10–12 mm; the plants treated as *Ophiorrhiza pauciflora* by H. S. Lo (in FRPS 71(1): 127. 1999) generally fall within var. *pauciflora* but have corollas that are intermediate in size and thus cannot be conclusively included in either of the Indian varieties (suggesting that the Indian varieties may not ultimately be separable).

**51. *Ophiorrhiza petrophila*** H. S. Lo, Bull. Bot. Res., Harbin 10(2): 66. 1990.

法斗蛇根草 *fa dou she gen cao*

Herbs, ascending, to 100 cm tall; stems drying dark brown or purplish black and shiny, slightly compressed to subterete, glabrous. Leaves in subequal pairs; petiole 0.5–1 cm, glabrous; blade drying papery, grayish green adaxially, pale abaxially, ovate or narrowly ovate, 2–7(–9) × 1.5–3(–3.5) cm, glabrous, base cuneate to obtuse, margins entire, apex cuspidate to shortly caudate; secondary veins 7–9 pairs; stipules caducous, not seen. Inflorescence 3–5 cm, many flowered, pilosulous to glabrescent; bracts filiform to subulate, 4–5 mm, obtuse, persistent. Flowers reportedly distylous, subsessile or on pedicels to 1.5 mm. Calyx glabrous; hypanthium turbinate, ca. 1.5 mm, 5-ribbed; lobes triangular, 0.7–1 mm, with 1 gland in each sinus. Corolla reddened, tubular-funnelform, outside glabrous; tube 10–11 mm, sparsely villous to scabrous throughout inside; lobes ovate-triangular, 1.5–1.8 mm, dorsally with broad lunate wing. Capsules purple, ca. 2.5 × 8 mm. Fl. May.

• Dense forests in limestone regions. Yunnan.

The protologue described this species as distylous but noted that long-styled flowers had not been seen; the putative short-styled flowers were said to have the anthers positioned in or shortly above the corolla throat and the stigmas situated near the middle of the corolla tube.

**52. *Ophiorrhiza pingbienensis*** H. S. Lo, Bull. Bot. Res., Harbin 10(2): 20. 1990.

屏边蛇根草 *ping bian she gen cao*

Herbs, ascending; stems drying reddish brown and usually angled, densely reddish brown pilosulous at least when young. Leaves in subequal pairs; petiole 0.5–2.5 cm, densely pilosulous; blade drying thinly papery, oblong-ovate, elliptic, oblong-lanceolate, or ovate, 2–7.5 × 1–3 cm, adaxially sparsely puberulent, abaxially glabrescent to usually densely puberulent on principal veins, base cuneate, margins entire, apex acute to obtuse; secondary veins 5–7 pairs; stipules persistent to deciduous, lanceolate to subovate, ca. 4 mm, entire or sparsely dentate, at base usually with 2 glands, acuminate and sometimes with small globose gland at apex. Inflorescence congested-cymose, several flowered, densely reddish brown pilosulous; peduncles 1–1.5 cm; axes relatively short, helicoid; bracts linear-lanceolate, spatulate, or lanceolate, 5–7 mm, often pinnately veined, subglabrous or ciliate, obtuse to subacute. Flowers with biology unknown, subsessile or on pedicels 1.5–3 mm. Calyx with hypanthium turbinate, ca. 1.5 mm, 5-ribbed, densely pilosulous; lobes lanceolate, subovate, or spatulate, unequal, largest ones 3–6 mm, smallest ones 0.8–3 mm, pinnately veined, ciliate or subglabrous. Corolla dark red, tubular-funnelform, outside 5-winged in upper part in bud and glabrescent; tube 15–17.5 mm, inside with 5 small villous fascicles below throat and just above anthers; lobes subovate to ligulate, 2.5–3 mm, inside densely shortly scaly pubescent, dorsally with broad lunate wing, apex rostrate. Immature capsule obcordate, ca. 2 × 5.5 mm, ferruginous pilosulous. Fl. Jul.

• Streamsides; ca. 1400 m. Yunnan (Pingbian).

This species was keyed by H. S. Lo (loc. cit.: 8, as "*qinbienensis*") based in part on its persistent, usually discernible stipule, although the accompanying figure there shows no stipules, which suggests these may be deciduous at least sometimes. As shown in the figure in the protologue, the pedicels described there could be considered inflorescence axes producing sessile flowers by others.

**53. *Ophiorrhiza pumila*** Champion ex Bentham, Hooker's J. Bot. Kew Gard. Misc. 4: 169. 1852.

短小蛇根草 duan xiao she gen cao

*Ophiorrhiza aureolina* H. S. Lo f. *qiongyaensis* H. S. Lo; *O. humilis* Y. C. Tseng; *O. inflata* Maximowicz; *O. pumila* var. *inflata* (Maximowicz) Masamune.

Herbs, weak to ascending, to 20(–30) cm tall; stems drying gray or grayish yellow, weakly rugose, densely tomentulose-villosulous. Leaves in subequal pairs; petiole 0.1–1.5 cm, densely tomentulose; blade drying papery, adaxially green, grayish green, or dark grayish brown, abaxially pale to red, ovate, lanceolate, elliptic, or elliptic-oblong, (0.5–)2–5.5(–9) × (0.4–)1–2.5 cm, adaxially subglabrous to sparsely strigillose or hispidulous, abaxially densely puberulent to tomentulose or sometimes glabrescent, base cuneate and generally decurrent, margins entire to somewhat undulate, apex acute to obtuse, subacuminate, or rounded; secondary veins 5–8 pairs; stipules caducous, linear, 1–3 mm, puberulent. Inflorescences congested-cymose, several to many flowered, densely tomentulose-puberulent; peduncle 0.3–1.2 cm; branched portion 5–10 × 10–12 mm; axes becoming helicoid; bracts few, narrowly triangular to linear, 0.3–2 mm. Flowers homostylous, sessile or on pedicels to 1.5 mm. Calyx with hypanthium subglobose, 0.8–1.2 mm, 5-ribbed, densely hispidulous except ribs glabrescent; lobes subtriangular to linear, 0.3–0.6 mm, glabrescent. Corolla white, tubular to inflated, outside puberulent to hispidulous; tube 2.5–2.8 mm, with villous ring in throat to villosulous throughout inside; lobes ovate-triangular, 1.2–1.5 mm, dorsally weakly ribbed, acute to obtuse. Capsules drying brownish yellow, mitriform or somewhat obcordate, 2–2.5 × 5–7 mm, hispidulous. Fl. Apr–Sep, fr. Jun–Oct.

Shady places on wet lands, streamsides or riversides in forests; 200–700 m. Fujian, Guangdong, Guangxi, Hainan, Jiangxi, Taiwan, Yunnan [Japan, N Vietnam].

The floral biology of this species was studied by Nakamura et al. (J. Jap. Bot. 81: 113–120. 2006), who found the plants studied in the Ryukyu Islands and Taiwan to be long-styled-monomorphic, not distylous as previously reported. They also observed very low pollination rates in wild plants and concluded that probably at least much of the reproduction in this species is through autogamy.

This species was reviewed recently by Duan and Lin (Acta Phytotax. Sin. 45: 878–879. 2007), who newly synonymized several names under *Ophiorrhiza pumila* but separated relatively smaller plants in *O. humilis*. However, these smaller plants were included within the circumscription of *O. pumila* by H. S. Lo (in FRPS 71(1): 171. 1999), who is followed here.

**54. *Ophiorrhiza purpurascens*** H. S. Lo in S. Y. Jin & Y. L. Chen, Cat. Type Spec. Herb. China (Suppl.), 191. 1999.

紫脉蛇根草 zi mai she gen cao

Herbs, often procumbent at base, ascending above; stems

densely brown villous or -hirsute with multicellular trichomes. Leaves in subequal pairs; petiole ca. 0.5 cm; blade drying papery, with veins purple, ovate, 1–3 × 0.5–1.7 cm, both surfaces brown villous with pubescence denser along veins abaxially, base rounded to obtuse and slightly oblique, margins entire, apex acute to subobtuse; secondary veins 5–8 pairs; stipules caducous, not seen. Inflorescences 1-flowered or fasciculate and few flowered, densely pubescent; peduncles or pedicels 3–10 mm; bracts filiform, ca. 5 mm. Flowers with biology unknown, pedicellate or pedunculate. Calyx with hypanthium ca. 1.5 mm; lobes filiform, 2.5–3 mm. Corolla white, slenderly subfunnelform, puberulent outside; tube 22–23 mm, with white villous ring at middle inside; lobes ovate-triangular, 3–4 mm, obtuse, puberulent marginally, dorsally narrowly winged. Capsules not seen. Fl. Sep.

• Shady places in ravines; ca. 1000 m. Sichuan (Xuyong).

**55. *Ophiorrhiza purpureonervis*** H. S. Lo, Bull. Bot. Res., Harbin 10(2): 42. 1990.

苍梧蛇根草 cang wu she gen cao

Herbs, apparently ascending, to 30 cm tall; stems glabrous. Petiole 0.3–0.5(–1) cm, glabrous; leaf blade drying papery, adaxially leaden gray, abaxially straw-yellow with veins purple, ovate, lanceolate, or broadly ovate, 2–7.5 × 1–4 cm, glabrous on both surfaces, base rounded or obtuse, margins entire, apex obtuse; secondary veins 6 or 7 pairs; stipules caducous, not seen. Inflorescences many flowered, densely ferruginous villosulous; peduncle 1.5–2.5 cm; axes stout, helicoid; bracts filiform, 2.5–3 mm, ciliate or sparsely hispidulous. Flowers reportedly distylous, sessile or on pedicels to 1 mm. Calyx with hypanthium obovoid, ca. 1.5 mm, 5-ribbed, densely pubescent; lobes lanceolate, ca. 1.5 mm, ciliate. Corolla white or pale yellow, slenderly funnelform, glabrous outside; tube ca. 10 mm, inside with white villous ring at middle and puberulent above; lobes sublanceolate, ca. 4 mm, dorsally with horn ca. 1 mm near apex. Immature capsules obcordate, ca. 1.5 × 4 mm, pubescent. Fl. Jul.

• Dense forests; 200–500 m. Guangxi (Cangwu).

In the protologue and FRPS (71(1): 145. 1999), H. S. Lo noted that this species is distylous but described only long-styled flowers, with the stigmas borne near the corolla throat and the anthers positioned below the middle of the corolla tube.

**56. *Ophiorrhiza rarior*** H. S. Lo in S. Y. Jin & Y. L. Chen, Cat. Type Spec. Herb. China (Suppl.), 191. 1999.

毛果蛇根草 mao guo she gen cao

Herbs, apparently ascending; stems moderately brown villous or -hirsute with multicellular trichomes to glabrescent, densely lenticellate when young. Petiole 4–6 cm, sparsely villous; leaf blade drying membranous-papery, adaxially olive-green, abaxially pale, narrowly elliptic-oblong, 13–21 × 4.5–5 cm, sparsely strigose adaxially, abaxially glabrescent except sparsely hirsute along veins, base acute, margins subentire, ciliate, apex acuminate or acute; secondary veins 14–18 pairs; stipules caducous, not seen. Inflorescences and flowers not seen. Infructescences branched to several orders, villous; peduncle ca. 8.5 cm, 4-angled; axes 4–5.5 cm, helicoid; bracts

lanceolate to linear-subulate, 4–8 mm, ciliate, persistent. Capsules mitriform, ca.  $4 \times 10$ –11 mm, crisped villous. Fl. Jun.

- Wet places in forests. Guangxi (Longzhou).

**57. *Ophiorrhiza repandicalyx*** H. S. Lo in S. Y. Jin & Y. L. Chen, Cat. Type Spec. Herb. China (Suppl.), 191. 1999.

大叶蛇根草 da ye she gen cao

Herbs, erect, to 100 cm tall; stems drying dark brown, rather stout, glabrous. Leaves in subequal pairs; petiole 0.8–1.5 cm, glabrous; blade drying papery, adaxially grayish green, abaxially pale green, broadly ovate, ovate, or elliptic, 15–22  $\times$  6–10 cm, glabrous on both surfaces, base obtuse then abruptly narrowed, apex cuspidate; secondary veins 11–16 pairs; stipules caducous, not seen. Inflorescences congested-cymose to subcapitate, many flowered, ca. 3 cm in diam., mealy pubescent; peduncle ca. 1.5 cm; axes helicoid; bracts absent. Flowers reportedly distylous. Calyx mealy pubescent; hypanthium broadly turbinate, ca. 2.1 mm; limb tubular, ca. 1.5 mm, undulate to shallowly 5-lobed. Corolla green, rather stoutly tubular, mealy puberulent outside; tube ca. 5.5 mm, white villous above middle inside; lobes triangular-ovate, ca. 1.5 mm, dorsally broadly winged and with horn ca. 0.5 mm near apex. Capsules unknown. Fl. Nov.

- Forests in ravines; ca. 1100 m. Yunnan (Jinghong).

The original description (H. S. Lo, Bull. Bot. Res., Harbin 10(2): 79–80. 1990, not validly published) noted that the flowers are distylous but described only a presumed long-styled form, with the anthers positioned near the middle of the corolla tube and the stigmas positioned at or just above the corolla throat.

**58. *Ophiorrhiza rhodoneura*** H. S. Lo, Bull. Bot. Res., Harbin 10(2): 45. 1990.

红脉蛇根草 hong mai she gen cao

Herbs, ascending, to 50 cm tall; stems subterete, rather stout, densely ferruginous villous with multicellular trichomes. Leaves in somewhat unequal pairs; petiole 1–4 cm, densely villous; blade drying subleathery-papery, with veins ferruginous-red abaxially, ovate or elliptic, 5.5–12  $\times$  2.5–6 cm, glabrous adaxially, villous on principal veins abaxially, base subrounded, apex acute; secondary veins 9–13 pairs; stipules caducous, not seen. Inflorescence congested-cymose and rather umbelliform to subcapitate, many flowered, densely villous; peduncles 3–3.5 cm; axes short, helicoid; bracts linear-spatulate, 10–13(–15) mm. Flowers reportedly distylous, subsessile. Calyx densely villosulous; hypanthium compressed turbinate; limb reduced, denticulate. Corolla funnelform, outside  $\pm$  pubescent; tube 24–27 mm, inside villous below middle; lobes subovate, 6–8 mm, pinnately veined, dorsally with narrow ciliate wing, apex rostrate. Capsules obcordate-mitriform, ca.  $4.5 \times 8$ –10 mm, villosulous. Fl. Sep, fr. Nov.

- Broad-leaved forests; ca. 1300 m. Guangxi (Napo).

In the protologue and FRPS (71(1): 148. 1999), H. S. Lo noted that this species is distylous but described only putative short-styled flowers, with the stigmas borne near the base of the corolla tube and the anthers positioned just below the corolla throat.

**59. *Ophiorrhiza rosea*** J. D. Hooker, Fl. Brit. India 3: 78. 1880.

美丽蛇根草 mei li she gen cao

Herbs or shrubs, to 100[–150] cm tall; stems drying rugose, grayish yellow, pilosulous becoming glabrescent. Leaves in subequal pairs; petiole 1–3(–5) cm, hirtellous; blade drying thinly papery, ovate, elliptic, or broadly ovate, [6.5–]10–22[–25]  $\times$  [2–]5–10 cm, glabrous adaxially, densely hispidulous along principal veins abaxially, base cuneate, obtuse, or subcordate, apex abruptly acute to acuminate; secondary veins 8–13(–16) pairs; stipules deciduous, 2-lobed nearly to base, 5–7 mm, lobes subulate, glabrescent. Inflorescence cymose to paniculate, many flowered, puberulent; peduncle 2.8–5 cm; axes helicoid; bracts reduced, caducous. Flowers with biology unknown, subsessile. Calyx densely mealy puberulent; hypanthium compressed turbinate, ca. 1.5 mm, 5-ribbed; lobes subtriangular, ca. 0.5 mm. Corolla purplish red, tubular-funnel-form, outside puberulent to glabrous, sometimes 5-ridged in bud; tube 8–9 mm, inside glabrous; lobes subovate, ca. 1 mm. Capsules broadly mitriform, ca.  $3 \times 8$  mm, subglabrous or mealy pubescent. Fl. Oct–Dec.

Broad-leaved forests; 1300–2100 m. Xizang (Mêdog), Yunnan [Bhutan, NE India, Myanmar, Thailand].

Measurements in brackets are taken from the description of this species by Deb and Mondal (Bull. Bot. Surv. India 39(1–4): 103–105. 1997) and may be expected in Chinese plants.

**60. *Ophiorrhiza rufipilis*** H. S. Lo, Bull. Bot. Res., Harbin 10(2): 17. 1990.

红毛蛇根草 hong mao she gen cao

Herbs, suberect to procumbent and rooting along lower portion; stems drying striate, densely reddish brown villous with multicellular moniliform trichomes. Leaves in markedly unequal pairs; petiole 1–5 cm, densely villous; blade drying papery, pallid green, oblong-lanceolate, lanceolate, elliptic, or subovate, larger ones 3–10  $\times$  1–4 cm, smaller ones 1–6  $\times$  0.5–2.5 cm, adaxially sparsely strigose-villous, abaxially densely pubescent on principal veins, base obtuse, subrounded, or occasionally subcordate, margins ciliate, apex acuminate or obtuse and abruptly acuminate; secondary veins in larger leaves 10–16 pairs, in smaller leaves 5–8 pairs; stipules generally persistent, lanceolate-triangular or usually 2-lobed, 7–9 mm, sparsely ciliate, long acuminate. Inflorescence cymose, several to many flowered, densely reddish brown villous; peduncle shorter than 1 cm; axes rather short, helicoid; bracts linear, ca. 5 mm, ciliate. Flowers with biology unknown, subsessile or on pedicels to 1.5 mm. Calyx with hypanthium turbinate-subglobose, ca.  $1.5 \times 1.5$  mm, densely villous; lobes subovate or lanceolate, 3.5–4 mm, glabrescent, pinnately veined, hispid along margin and midrib, acute to shortly rounded. Corolla white or pale yellow, funnel-form, outside glabrescent with 5 hispid or villous lines on ridges; tube 18–19 mm, sparsely scaly pubescent inside; lobes lanceolate to ovate, ca. 4.5 mm, dorsally with broad ciliate wings, apex rostrate. Immature capsules subobcordate, ca.  $3.5 \times 7$  mm, 5-ribbed, villosulous. Fl. Feb.

- Dense forests; ca. 1200 m. SE Yunnan.

**61. *Ophiorrhiza rufopunctata*** H. S. Lo, Bull. Bot. Res., Harbin 10(2): 15. 1990.

红腺蛇根草 hong xian she gen cao

Herbs, weak at base, ascending above, to 15 cm tall; stems brownish hispidulous or -strigose. Leaves in somewhat unequal pairs; petiole 0.3–1.5 cm, pilosulous or hirsutulous; blade drying papery, oblong-ovate, ovate, or broadly ovate, 3–8(–10) × 2–3.5 cm, adaxially glabrescent and usually with scattered reddened gland dots, abaxially with red gland dots and glabrous or hispidulous to strigose on veins, base obtuse to subrounded or subcordate, often oblique, margins undulate, apex obtuse, subrounded, or acute; secondary veins 4 or 5 pairs; stipules persistent at least on upper nodes, subtriangular to ovate, 2–3 mm, obtuse and glandular at apex. Inflorescence 1-flowered or usually cymose and 2–5-flowered, densely brown hispidulous; peduncle ca. 1 cm; bracteoles linear-subulate, ca. 3 mm, usually hirtellous and/or with reddish gland dots. Flowers distylous, on short pedicels. Calyx hispidulous and/or with red gland dots; hypanthium turbinate to ellipsoid, ca. 3 mm, 5-ribbed; lobes linear, ca. 3 mm, each sinus with 1 gland. Corolla pale purple, funnellform; tube 18–22 mm, white villous or pilosulous above middle and densely pilosulous at middle inside; lobes ovate, 4–5 mm, dorsally ridged and with very small horn. Capsules 5–6 × ca. 11 mm, hispidulous. Fl. Nov.

- Wet places in forests. Sichuan.

In the protologue and FRPS (71(1): 118. 1999), H. S. Lo noted that the short-styled flowers have the anthers situated in the upper part of the corolla tube and the stigmas situated near its middle, while the long-styled flowers have the anthers situated near the middle of the corolla tube and the stigmas in its throat.

**62. *Ophiorrhiza rugosa*** Wallich in Roxburgh, Fl. Ind. 2: 547. 1824.

匍地蛇根草 pu di she gen cao

*Ophiorrhiza harrisiana* Heyne ex G. Don var. *rugosa* (Wallich) J. D. Hooker; *O. prostrata* D. Don; *O. prostrata* var. *rugosa* (Wallich) Panigrahi & S. K. Kar.

Herbs, sometimes annual, weak to erect, to 60 cm tall; stems pilosulous to tomentulose. Leaves in subequal pairs; petiole 0.5–1.5(–3) cm, puberulent to tomentulose; blade drying thinly papery, ovate-lanceolate, lanceolate, or elliptic, 2–6(–11) × 1–3(–5) cm, adaxially glabrous to sparsely strigillose or hispidulous, abaxially pilosulous or hispidulous along principal veins, base cuneate to obtuse, apex caudate-acuminate, obtuse, acute, or weakly acuminate; secondary veins 5–7(–11) pairs; stipules generally persistent on uppermost nodes, triangular then contracted to linear, 4–10 mm, puberulent to glabrescent. Inflorescence cymose to congested-cymose, several to many flowered, pilosulous to glabrescent; peduncles 1.5–3 cm; axes short to developed, becoming helicoid; bracts few, deciduous, linear, 2–3 mm. Flowers with biology unknown, subsessile. Calyx puberulent; hypanthium ellipsoid, ca. 0.8 mm; lobes 0.2–1.5 mm. Corolla pink to white, tubular-funnelform, outside puberulent to glabrous; tube 3–6 mm, inside with pubescent ring near or above middle; lobes triangular, 1–2 mm, dorsally smooth to ridged. Capsules obconic, 2–2.5 × 4–5 mm, puberulent to glabrescent.

Evergreen forests; 1700–3400 m. Xizang, Yunnan (Gongshan) [Bhutan, NE India, Nepal, Sri Lanka].

The description here is based mostly on the description by Deb and Mondal (Bull. Bot. Surv. India 39(1–4): 107–118. 1997); the elevational range is taken from Fl. Bhutan (2(2): 778. 1999). This species was treated by Deb and Mondal as a widespread, morphologically rather variable species; Fl. Bhutan noted that this species is variable and not well circumscribed.

**63. *Ophiorrhiza salicifolia*** H. S. Lo, Bull. Bot. Res., Harbin 10(2): 50. 1990.

柳叶蛇根草 liu ye she gen cao

Subshrubs, apparently ascending, to 1 m tall; stems flattened to terete, subglabrous. Leaves in subequal pairs; petiole 0.5–1.5 cm, subglabrous; blade drying papery, red, lanceolate-linear, ± falcate, 4.5–11 × 0.6–1.5 cm, subglabrous on both surfaces, base cuneate, apex subobtuse; secondary veins 9–11 pairs; stipules caducous, not seen. Inflorescences and flowers not seen. Infructescences cymose-paniculate, 10–12 × ca. 8 cm, branched to several orders, pubescent; peduncles 4–6.5 cm; axes dichotomous to helicoid; bracteoles linear, 4–5 mm, subglabrous, persistent; pedicels 2–3 mm. Capsules mitriform, 2.5–3 × 7–8 mm, puberulent. Fr. May.

- Wet fertile soil. Guangxi (Shangsi).

**64. *Ophiorrhiza sichuanensis*** H. S. Lo, Guihaia 11: 104. 1991.

四川蛇根草 si chuan she gen cao

Herbs, procumbent in lower portion, ascending above; stems drying black, subglabrous or puberulent. Leaves in subequal pairs; petiole 0.8–2 cm, subglabrous; blade drying thickly papery, adaxially leaden gray, abaxially dark brown, broadly elliptic, 1.5–5 × 1.2–3.2 cm, glabrous on both surfaces, base rounded to obtuse, margin irregularly dentate or rarely entire, apex obtuse or acute; secondary veins 4–6 pairs; stipules generally persistent, subulate, 1.5–2 mm, acuminate. Inflorescences 1- or 2-flowered; bracts linear, 4–6 mm. Flowers with biology unknown, on pedicels 6–8 mm. Calyx with hypanthium broadly turbinate, ca. 2.5 mm, 5-ribbed; lobes linear, 3.5–4 mm, slightly obtuse. Corolla purple, funnellform, outside glabrous; tube 26–29 mm, white villous inside; lobes ovate-triangular, ca. 6 mm, apex rostrate. Capsules not seen. Fl. Apr.

- On rocks; ca. 1200 m. Sichuan (Leibo).

**65. *Ophiorrhiza subrubescens*** Drake, J. Bot. (Morot) 9: 215. 1895.

变红蛇根草 bian hong she gen cao

Herbs, weak to suberect, to 60 cm tall; stems glabrous to pubescent. Leaves in subequal pairs; petiole 0.5–2(–4) cm, densely pilose; blade drying thinly papery, red on both surfaces or grayish green adaxially, lanceolate to ovate, 3–11 × 1–4 cm, glabrous or sparsely strigose adaxially, ?pilose along principal veins abaxially, base cuneate, margins entire or undulate, apex rounded-obtuse to acuminate or acute; secondary veins 7–13 pairs; stipules sometimes caducous, broadly triangular then strongly narrowed, 2–3 mm. Inflorescence congested-cymose, many flowered, densely pubescent; peduncle 1–6 cm; axes heli-

coid, up to 1 cm, elongating as fruit develop; bracts absent, minute, or caducous. Flowers reportedly distylous, subsessile. Calyx densely pubescent; hypanthium subobcordate, ca. 1 mm, 5-ribbed; lobes subtriangular, ca. 0.5 mm. Corolla slenderly tubular, 6–8(–12) mm, outside pubescent and 5-ribbed at least in bud, inside with white villous ring at middle and scaly pubescent in throat and onto lobes; lobes triangular to subovate, dorsally narrowly winged and with very short horn. Capsules drying purplish red, obcordate, ca.  $3 \times 7$ –8 mm, pubescent. Fl. Apr–Jul.

Shady and wet places in forests. Guangxi, Hainan, Yunnan [N Vietnam].

The circumscription of this species here follows that of H. S. Lo in FRPS (71(1): 139. 1999), which partly differs from that of other authors and also conflicts with the protologue in some details. The protologue described the plants as glabrous with filiform stipules and bracts that fall before the fruit mature, while H. S. Lo said they are pubescent with narrowly triangular stipules and lacking bracts. Lo described the flowers as distylous with the corollas apparently similar in both floral forms but unusual in anther position: the forms were described as differing in style length, ca. 2 mm vs. ca. 6 mm, and anther size, ca. 2 mm vs. ca. 3 mm, but with the anthers in both forms positioned near the base of the corolla, at  $\pm$  the same height as the short-styled stigmas but well below the long-styled stigmas. However, the figure in FRPS (p. 140, t. 33, f. 1–8) differs from Lo's description in its depiction of well-developed bracts that persist with the flowers, deeply bilobed stipules, corollas with only 1 ring of internal pubescence, glabrous fruit, and flower forms with the anthers of the short-styled flowers exerted on well-developed filaments.

**66. *Ophiorrhiza succirubra*** King ex J. D. Hooker, Fl. Brit. India 3: 82. 1880.

高原蛇根草 gao yuan she gen cao

Herbs to subshrubs, weak to erect, to 60[–75] cm tall, usually drying partly to wholly red; stems glabrous or with pilosulous lines. Leaves in subequal pairs; petiole 0.5–2 cm, glabrous or subglabrous; blade drying thinly papery, lanceolate-elliptic, ovate-elliptic, or elliptic-oblong, 5–11(–20)  $\times$  2.5–4(–8) cm, glabrous on both surfaces or sparsely pubescent adaxially, base cuneate to obtuse, margins entire or undulate, apex acuminate to caudate; secondary veins 7–10 pairs; stipules caducous, not seen. Inflorescence congested-cymose, many flowered, often pendulous later becoming erect, glabrescent or axes sometimes puberulent to pilosulous in lines; peduncle 1–1.5[–3] cm; axes short; bracts linear-lanceolate, 6–9 mm. Flowers perhaps homostylous, on pedicels 1–1.5 mm. Calyx glabrous to puberulent or densely pilosulous; hypanthium submitriform, ca. 1.5 mm, 5(or 10)-ribbed; lobes ovate-triangular to lanceolate-triangular, usually slightly unequal, 1.4–1.8 mm, with 1 gland in each sinus. Corolla pink or white, tubular-funnelform and swollen at base, outside glabrous; tube 7–7.5[–10] mm, inside glabrous or villous; lobes ovate, ca. 2.5 mm, dorsally narrowly keeled. Capsules mitriform, [2–3.5  $\times$  6–9 mm], glabrous to puberulent or pilosulous. Fl. Jul–Oct.

Broad-leaved forests; ca. 2000 m or more. Guizhou, Xizang (Médog), Yunnan [Bhutan, NE India, Myanmar, Nepal].

This species has apparently been distinguished based primarily on its distinctive purple-red drying color; it is characterized further in the key to species here.

Measurements in brackets are taken from the description of this species by Deb and Mondal (Bull. Bot. Surv. India 39(1–4): 120–122. 1997), where this species is reported to flower throughout the year and grow from middle elevations up to 2400 m. H. S. Lo (in FRPS 71(1): 145–146. 1999) did not posit the floral biology but described the flowers similarly to Deb and Mondal as essentially homostylous, with the anthers and stigmas both positioned near the middle of the corolla tube.

**67. *Ophiorrhiza umbricola*** W. W. Smith, Notes Roy. Bot. Gard. Edinburgh 12: 217. 1920.

阴地蛇根草 yin di she gen cao

Herbs, sometimes weak at base, ascending above, to 45(–100) cm tall; stems obtusely 4-angled, drying purple, glabrous or subglabrous. Petiole 1–4 cm, subglabrous; leaf blade drying membranous or thinly papery, adaxially dark green, abaxially pale green or red, ovate, elliptic, or lanceolate, 9–15  $\times$  3–6.5 cm, glabrous on both surfaces or sparsely strigillose adaxially, base cuneate to obtuse, apex long acuminate or cuspidate; secondary veins 10–14 pairs; stipules caducous, not seen. Inflorescences congested-cymose, many flowered, glabrous or reddish brown hirtellous; peduncle 1.5–3 cm; axes helicoid. Flowers reportedly distylous, subsessile or on pedicels to 1 mm. Calyx glabrous; hypanthium submitriform, 1.5–2 mm; lobes with 1 gland in each sinus. Corolla red or purplish red, subtubular, glabrous outside; tube 22–24 mm, white hirsute above middle inside; lobes ovate-triangular, 3(–6) mm. Capsules drying red, mitriform, 10–11 mm wide. Fl. Jun.

Dense forests; 2000–3000 m. Xizang (Médog), Yunnan [Myanmar].

H. S. Lo (in FRPS 71(1): 151. 1999) described this species as distylous but described only putatively long-styled flowers, with the anthers positioned just above the middle of the corolla tube and the stigmas apparently positioned just above them.

**68. *Ophiorrhiza wallichii*** J. D. Hooker, Fl. Brit. India 3: 79. 1880.

大果蛇根草 da guo she gen cao

Herbs, weak at base, ascending above, to 20[–60] cm tall; stems pilosulous [to glabrous]. Leaves in unequal [to subequal] pairs; petiole [0.5–]1–3 cm or longer, glabrous; blade drying thickly papery [or leathery], adaxially grayish green, abaxially greenish yellow, ovate, sub lanceolate, or elliptic-oblong, 3–14[–15]  $\times$  2–4.5[–6] cm, subglabrous on both surfaces, base obtuse and often shortly decurrent, distinctly inequilateral [or symmetrical], margins entire or undulate, apex acuminate or cuspidate; secondary veins 7 or 8(or 9) pairs; stipules caducous, reduced, subulate. Inflorescences corymbose to congested-cymose, several to many flowered, puberulent to subglabrous; peduncle 1–1.5 cm; axes short or 0.5–1 cm, helicoid; bracts linear, 2–3 mm, caducous. Flowers with biology unknown, on pedicels 1–2 mm. Calyx densely puberulent; hypanthium broadly compressed turbinate, ca. 1 mm, 5-ribbed; lobes triangular, ca. 0.4[–1.5] mm, each sinus with 1 gland. Corolla pale red, drying yellow, salverform, glabrous outside; tube 23–25[–27] mm, glabrous inside; lobes ovate-triangular, [2–]5 mm, dorsally narrowly winged, apex rostrate. Capsules mitriform, 5–6  $\times$  14–15 mm, puberulent. Fl. Apr–Jun.

Shady and wet places in forests. Yunnan [NE India, Myanmar].

Measurements in brackets are taken from the description of this species by Deb and Mondal (Bull. Bot. Surv. India 39(1-4): 135-137. 1997) and may be expected in Chinese plants.

**69. *Ophiorrhiza wenshanensis*** H. S. Lo, Bull. Bot. Res., Harbin 10(2): 17. 1990.

文山蛇根草 wen shan she gen cao

Herbs, weak in lower part, ascending above, to 20 cm tall; stems densely pilosulous to hispidulous. Petiole 0.5-1 cm, hispidulous; leaf blade drying papery, adaxially grayish green, pallid abaxially, ovate to lanceolate, 1.5-3.5(-7) × 0.8-2(-3) cm, subglabrous to sparsely hispidulous adaxially, subglabrous except pilosulous on veins abaxially, base cuneate to obtuse, apex obtuse; secondary veins 5 or 6 pairs; stipules glabrous, 2-parted almost to base, 2.5-3 mm, lobes subulate-triangular, with globose gland at apex and sometimes also stipitate glands at base. Inflorescences 1- or 2-flowered, glabrous; pedicels 3-5 mm; bracts 2, fused to hypanthium base, linear-subulate, ca. 5 mm. Flowers reportedly distylous, pedicellate or pedunculate. Calyx glabrous; hypanthium turbinate, ca. 1.5 mm, 6-8-ribbed; lobes 5-7, lanceolate-linear, sometimes unequal, 1-3 mm. Corolla white, funnellform with throat markedly expanded, outside glabrous; tube 18-20 mm, densely white villous inside through throat; lobes 6 or 7, subovate, 3-4 mm, dorsally with very short horn, apex rostrate. Capsules subobcordate, ca. 3 × 8 mm, with persistent bracteoles. Fl. May.

• Streamsides in forests. Yunnan (Wenshan).

In the protologue and FRPS (71(1): 120. 1999), H. S. Lo described the flowers as probably distylous, but only the putative short-styled form has been documented.

**70. *Ophiorrhiza wui*** H. S. Lo, Bull. Bot. Res., Harbin 10(2): 33. 1990.

吴氏蛇根草 wu shi she gen cao

Herbs, procumbent at base, ascending above, to 30 cm tall; stems drying reddish brown, subterete to striate-grooved, puberulent to densely pilosulous. Leaves in subequal pairs; petiole 1-2.5 cm, pilosulous; blade drying thinly papery, ovate or lanceolate-ovate, 5-11 × 1.8-4 cm, adaxially glabrous or sparsely strigillose, abaxially villosulous or hirtellous along veins, base cuneate then shortly decurrent, apex obtuse then abruptly acuminate; secondary veins 5-7 pairs; stipules subfiliform, ca. 6 mm. Inflorescences cymose, several flowered, branched to several orders, on peduncles and axes with 2 pilosulous or strigillose lines; peduncle 1-2.5 cm; axes helicoid; bracts absent or reduced. Flowers with biology unknown, sessile. Calyx with hypanthium ca. 1.5 mm; lobes ca. 0.4 mm. Corolla white or reddish, tubular, glabrous outside; tube 4.5-5 mm, densely pubescent in throat; lobes oblong-triangular, ca. 2 mm, dorsally winged, markedly reflexed in anthesis. Capsules unknown. Fl. Apr.

• On wet limestone; ca. 1100 m. Yunnan (Luxi).

## **66. PAEDERIA** Linnaeus, Syst. Nat., ed. 12, 2: 135, 189; Mant. Pl. 1: 7, 52. 1767, nom. cons.

鸡矢藤属 ji shi teng shu

Chen Tao (陈涛); Charlotte M. Taylor

*Daun-contu* Adanson.

Shrubs, subshrubs, or vines, unarmed, usually extensively twining, usually with fetid odor when bruised. Raphides present. Leaves opposite or infrequently in whorls of 3 or 4, without or sometimes with (*Paederia foetida*, *P. spectatissima*) pubescent domatia; stipules caducous or persistent, interpetiolar, triangular to bilobed. Inflorescences axillary and/or terminal on main stem or often on short lateral stems, thyriform, paniculate, cymose, or spiciform, several to many flowered, sessile to pedunculate, bracteate with bracts sometimes enlarged and stipitate [to petaloid]. Flowers sessile to pedicellate, bisexual, monomorphic. Calyx limb (4 or)5(or 6)-lobed [sometimes with calycophylls]. Corolla white, pink, or purple, funnellform usually with tube very slender then abruptly enlarged shortly above base, inside pubescent in tube and throat, sometimes fenestrate near base; lobes (4 or)5(or 6), induplicate-valvate in bud, with margins often crisped to irregular, rarely shortly trifid at apex. Stamens (4 or)5(or 6), included, inserted at various levels near middle of corolla tube, included; filaments reduced [or sometimes developed]; anthers dorsifixed. Ovary 2(or 3)-celled, ovules 1 in each cell, erect, basal, anatropous; stigmas 2, filiform, included or exserted. Fruit characteristic: dry, drupaceous becoming schizocarpous, globose or compressed globose to compressed ellipsoid, with calyx limb persistent and occasionally becoming enlarged; exocarp dry, membranous to papery, usually drying shiny, at maturity fragmenting; pyrenes ("diaspores") 2(or 3), indehiscent, membranous to leathery, hemispherical to flattened, oblong to ovate in outline, entire to winged, rarely pubescent (*P. yunnanensis*), sometimes borne on a persistent carpophore; seeds with testa thin; cotyledons broadly cordate; radicle short, hypogeous.

Thirty species: tropical and subtropical Africa, Asia, Madagascar, North America (Mexico), and South America; nine species (three endemic) in China.

*Paederia* was studied in detail by Puff and collaborators (in Puff, Opera Bot. Belg. 3: 1-376. 1991). They recognized three subgenera based on corolla morphology and size, anther position, style length, the presence of petaloid bracts, and fruit morphology. Two of their subgenera are found in China: *P.* subg. *Paederia*, which is restricted to SE Asia and includes *P. cavaleriei*, *P. foetida*, *P. pertomentosa*, and *P. stenobotrya*; and *P.* subg. *Alatopaederia* Puff, which is found worldwide except continental Africa and includes the remaining Chinese species. Puff (loc. cit.: 207-292) presented a species-level taxonomy of Asian *Paederia* that differed significantly from that of other authors, including W. C. Ko (in FRPS 71(2): 110-119. 1999). In particular, he recognized fewer species, circumscribed *P. foetida* more widely, and accordingly synonymized several names. Puff also applied the name *P. foetida* differently than previous authors, and his conclusions were not adopted in FRPS: he applied the name *P. foetida* to plants

treated by W. C. Ko (loc. cit.: 118–119) as *P. scandens*, and he included the plants treated as *P. foetida* by W. C. Ko (loc. cit.: 112–113) in *P. cruddasiana*. Puff (loc. cit.: 216–220) discussed in detail the confusion of these species and the typification of *P. foetida* and synonymized *P. scandens* under *P. foetida*. The treatment here follows Puff, which is well documented and internally consistent, and thus is distinct from traditional taxonomy of SE Asian *Paederia*.

The fruit of *Paederia* are unusual in Rubiaceae: they are drupaceous in structure but dry and tardily schizocarpous with the exocarp fragmenting to expose the two pyrenes, which are the dispersal unit or diaspores, sometimes simply enclosed in the fruit and sometimes borne on carpophores (Puff, loc. cit.: 1–376). *Paederia* species are best distinguished by fruit characters; determinations of flowering specimens are usually provisional. The corollas of most species of *Paederia* have a notable size range, sometimes varying by 100–200. *Paederia foetida* is by far the most commonly collected Asian species of the genus and one of the most commonly collected species of Rubiaceae in China. The descriptions below follow Puff (loc. cit.: 207–292) in describing primarily what he termed the “mid-stem region,” i.e., the mature stems below the apical, young region. Inflorescence morphology was used by Puff in part to distinguish species; however, these are indeterminate and in several species continue to grow. In particular, their axes continue to elongate for some time during the flowering period; thus, if inflorescences of different ages are compared these characters can be problematic to interpret. W. C. Ko (loc. cit.: 111) described the anthers as basifixed or dorsifixed, but Puff (loc. cit.) reported them as dorsifixed.

### Key to fruiting material

- 1a. Fruit globose to subglobose, 4–7 mm in diam.; pyrenes hemispherical to concavo-convex or plano-convex.
  - 2a. Inflorescences paniculate, thyriform, corymbiform, or cymose, usually branched to several orders and with flowers in open cymose groups, dichotomous or frequently with higher order axes scorpioid; stipules 1.5–6 mm ..... 3. *P. foetida*
  - 2b. Inflorescences narrowly paniculate, racemiform, or spiciform, branched to 1 or several orders and with flowers in congested groups to small heads, axes when developed usually dichotomously branched; stipules 2–12 mm.
    - 3a. Stipules 2–3.5 mm; calyx lobes 0.6–1 mm ..... 5. *P. pertomentosa*
    - 3b. Stipules 4–12 mm; calyx lobes 0.4–2 mm.
      - 4a. Calyx lobes 0.4–1 mm; leaf margins flat or often finely and extensively crisped; plants of mainland and Taiwan ..... 1. *P. cavaleriei*
      - 4b. Calyx lobes 1–2 mm; leaf margins flat; plants of mainland and Hainan ..... 8. *P. stenobotrya*
- 1b. Fruit orbicular, ovoid, or ellipsoid, rounded to strongly flattened, 5–15.5 × 4.5–11 mm; pyrenes flattened, orbicular, ovate, or elliptic in outline, sharply edged to marginally winged.
  - 5a. Stipules 1–1.5 mm; fruit 10–11 mm wide, flattened; pyrenes papery; calyx lobes 0.3–0.6 mm; inflorescence branched to several orders, becoming diffuse with well-developed axes, these usually ascending ..... 7. *P. spectatissima*
  - 5b. Stipules 2.5–25 mm; fruit 4.5–10 mm wide, rounded to flattened (if stipules less than 4 mm then fruit 4.5–8 mm wide); calyx lobes 0.5–2 mm.
    - 6a. Stipules 9–25 mm.
      - 7a. Fruit 5–7 mm; calyx lobes 0.5–0.8 mm ..... 6. *P. praetermissa*
      - 7b. Fruit 6–9 mm; calyx lobes 0.5–1.7 mm ..... 9. *P. yunnanensis*
    - 6b. Stipules 2.5–8.9 mm.
      - 8a. Stipules 2.5–6 mm ..... 2. *P. cruddasiana*
      - 8b. Stipules 4–8.9 mm.
        - 9a. Fruit 9–15 × 7–9 mm ..... 4. *P. lanuginosa*
        - 9b. Fruit 6–9 × 5–7 mm ..... 9. *P. yunnanensis*

### Key to flowering material

- 1a. Well-developed inflorescences paniculate, thyriform, corymbiform, or cymose, usually branched to several orders (up to 10) and with flowers borne separated in open cymose groups, with axes dichotomous or frequently higher order axes scorpioid; stipules 1–6 mm.
  - 2a. Inflorescences becoming diffuse, axes mostly dichotomously branched, well developed, and ascending; stipules 1–1.5 mm ..... 7. *P. spectatissima*
  - 2b. Inflorescences small to extensive and spreading, with axes dichotomously branched and/or often highest order axes markedly scorpioid; stipules 1.5–6 mm.
    - 3a. Flowers generally borne in small rather congested groups; calyx lobes 0.4–2 mm; corolla lobes 2–4 mm; pyrenes somewhat flattened ..... 2. *P. cruddasiana*
    - 3b. Flowers generally borne in branched cymules; calyx lobes 0.4–1 mm; corolla lobes 1–2 mm; pyrenes hemispherical ..... 3. *P. foetida*
- 1b. Well-developed inflorescences paniculate, racemiform, or spiciform, branched to 1 to several orders and with flowers usually congested in small groups or heads, with axes short and dichotomously branched or sometimes unbranched; stipules 2–25 mm.
  - 4a. Calyx limb with short tube and lobes deltoid and ± equal in length to tube; stipules 9–25 mm ..... 6. *P. praetermissa*

- 4b. Calyx limb lobed to base or with very short tube, lobes linear, ovate, suborbicular, or triangular and longer than tube; stipules 2–15 mm.
- 5a. Stipules 2–3.5 mm; leaves usually with sides generally parallel; inflorescences with secondary axes often not developed ..... 5. *P. pertomentosa*
- 5b. Stipules 4.5–15 mm; leaves generally with sides curved; inflorescences with secondary axes at least shortly developed.
- 6a. Corolla tube 15.5–17.5 mm ..... 4. *P. lanuginosa*
- 6b. Corolla tube 4–10.5 mm.
- 7a. Plants of mainland and Hainan; leaves 6–17 × 3–7 cm; corolla tube 5–6 mm; fruit usually drying orange-yellow; pyrenes plano-convex or concavo-convex ..... 8. *P. stenobotrya*
- 7b. Plants of mainland and Taiwan; leaves 6–22 × 2.5–13 cm; corolla tube 4–10.5 mm; fruit drying straw-yellow to brown, gray, or black; pyrenes plano-convex to concavo-convex or flattened.
- 8a. Leaf margins flat or often finely crisped; stems densely hirsute, hirtellous, pilosulous, and/or tomentose to glabrescent; calyx lobes 0.4–1 mm; pyrenes plano-convex to concavo-convex ..... 1. *P. cavaleriei*
- 8b. Leaf margins flat; stems densely tomentulose and/or hirtellous to glabrescent; calyx lobes 0.5–1.7 mm; pyrenes flattened ..... 9. *P. yunnanensis*

**1. *Paederia cavaleriei*** H. Léveillé, Repert. Spec. Nov. Regni Veg. 13: 179. 1914.

耳叶鸡矢藤 er ye ji shi teng

Vines, to 4 m; stems densely hirsute and/or hirtellous, pilosulous, or tomentulose to glabrescent, drying brown. Leaves opposite; petiole 2–8(–21) cm, densely hirsute or hirtellous to glabrescent; blade drying submembranous to papery, ovate, oblong-ovate, lanceolate, rhombic-ovate, or oblong, 6–18(–22) × 2.5–10(–13) cm, adaxially sparsely to densely strigillose, hirtellous, hirsute, or scabrous, abaxially sparsely to densely pilosulous to hirtellous with pubescence denser on veins, base rounded or truncate to cordate or usually cordate, margin flat or usually densely finely crisped and often appearing denticulate, apex acute to long acuminate; secondary veins 5–10 pairs; stipules generally persistent, triangular to lanceolate, 5–12 mm, acute to acuminate. Inflorescences axillary and/or terminal, paniculate to racemiform, cylindrical to narrowly pyramidal, 7–20(–30) cm, branched to 2–4 orders, densely hirtellous, pilosulous, or hirsute, pedunculate; bracts triangular to linear, 1–3 mm; pedicels to 1 mm. Flowers sessile to pedicellate in congested cymes or small heads. Calyx puberulent to glabrous; hypanthium portion ellipsoid to turbinate, 1–1.6 mm; limb lobed nearly to base; lobes triangular, 0.4–1 mm. Corolla pinkish gray, lilac gray, grayish white, or purplish green, tubular-funnelform, outside densely mealy tomentose or mealy puberulent; tube 4–10 × 2.5–4.5 mm, without slits; lobes broadly triangular to broadly ovate, 1–2 mm, obtuse to acute. Fruit globose, 4.5–5 × 4.5–5 mm, puberulent to glabrous, drying straw-yellow; pyrenes plano-convex to concavo-convex. Fl. Apr–Aug, fr. Aug–Nov.

• Thickets on mountains; 100–3000 m. Guangdong, Guangxi, Guizhou, Hubei, Hunan, ?Sichuan, Taiwan [?Laos].

**2. *Paederia cruddasiana*** Prain, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 67: 295. 1898.

臭鸡矢藤 chou ji shi teng

*Paederia cruddasiana* subsp. *microcarpa* (Kurz) Puff; *P. foetida* Linnaeus var. *microcarpa* Kurz.

Vines, to 10 m; stems moderately to sparsely hirtellous or

strigillose to glabrous, drying yellowish brown. Leaves opposite; petiole 1–3 cm, hirtellous or strigillose to glabrescent; blade drying membranous, ovate, lanceolate, or narrowly lanceolate, 5–16 × 2–10.5 cm, adaxially glabrous or puberulent on principal veins, abaxially sparsely hirtellous to glabrous on blade and sparsely to moderately puberulent or hirtellous along veins, base rounded to truncate or cordate, margins flat, apex acute to weakly acuminate; secondary veins 4–8 pairs; stipules generally persistent, ovate-lanceolate to broadly triangular, 2.5–6 mm, acute or bifid. Inflorescences axillary and/or terminal, paniculate, pyramidal, 6–50 cm, branched to 3–5 orders, hirtellous to glabrescent, pedunculate; bracts triangular to linear, 0.5–2 mm; pedicels to 2 mm. Flowers subsessile to pedicellate in cymes. Calyx puberulent to glabrescent; hypanthium portion ellipsoid, ca. 1 mm; limb lobed nearly to base; lobes triangular, 0.4–2 mm. Corolla purplish blue, lilac, or pink, funnelform, outside densely puberulent to tomentulose; tube 6–16 × 1.5–4.5 mm, without slits; lobes triangular, 2–4 mm. Fruit broadly ellipsoid to ovoid, somewhat laterally compressed, 6–11 × 4.5–8 mm, glabrescent, drying yellowish gray; pyrenes ovate to elliptic, somewhat flattened, marginally winged. Fl. May–Jun, fr. Nov–Dec.

Open forests; 100–1900 m. Yunnan [Bangladesh, Bhutan, India, Myanmar, Nepal, Thailand, Vietnam].

This species has long been incorrectly treated by several previous authors as *Paederia foetida*, including by W. C. Ko (in FRPS 71(2): 112–113. 1999); see comments above in the genus discussion. Puff (Opera Bot. Belg. 3: 251–252. 1991) recognized two subspecies of *P. cruddasiana*, distinguished by fruit and pyrene size and form, and included some Chinese plants in subsp. *cruddasiana* and others in subsp. *microcarpa*. The distribution of these subspecies is apparently complementary (Puff, loc. cit.: 252, f. 11), with the plants in the SE range of this species falling into subsp. *microcarpa*; however, the measurements that separate these taxa are overlapping generalizations, based on study of ten collections of subsp. *cruddasiana* and four collections of subsp. *microcarpa* from China, with several collections of each subspecies apparently found in the same relatively small region (e.g., *Mengla Exped. 34288*, subsp. *microcarpa*, and *Li Y. H. 317*, subsp. *cruddasiana*, both reported as 21°30'N 101°25'E; this latter collection apparently not mapped in his f. 11). Given the large morphological variation documented within other species of *Paederia*, the few specimens studied by Puff, and the geographic overlap, these varieties are provisionally not recognized here pending further study.

**3. *Paederia foetida*** Linnaeus, Syst. Nat., ed. 12, 2: 189; Mant. Pl. 1: 52. 1767.

鸡矢藤 *ji shi teng*

*Gentiana scandens* Loureiro; *Paederia chinensis* Hance; *P. dunniana* H. Léveillé; *P. esquirolii* H. Léveillé; *P. laxiflora* Merrill ex H. L. Li; *P. mairei* H. Léveillé; *P. scandens* (Loureiro) Merrill; *P. scandens* f. *mairei* (H. Léveillé) Nakai; *P. scandens* var. *mairei* (H. Léveillé) H. Hara; *P. scandens* var. *tomentosa* (Blume) Handel-Mazzetti; *P. tomentosa* Blume; *P. tomentosa* var. *glabra* Kurz; *P. tomentosa* var. *mairei* (H. Léveillé) H. Léveillé; *P. stenophylla* Merrill.

Vines, to 5 m; stems glabrous to densely puberulent, hirtellous, or pilosulous often becoming glabrescent, drying gray to brown. Leaves opposite or rarely ternate; petiole 0.5–9 cm, glabrous to densely hirtellous or pilosulous; blade drying papery to subleathery, ovate, ovate-oblong, lanceolate, lanceolate-elliptic, or elliptic, (1–)5–9(–21) × 1–4(–9) cm, adaxially glabrous to puberulent at least on principal veins, abaxially glabrous to puberulent, hirtellous, or strigillose at least on principal veins, base cuneate, rounded, truncate, or sometimes cordulate to cordate, margins flat, apex acute or acuminate; secondary veins 4–6 pairs; stipules generally persistent, triangular to ovate, 1.5–6 mm, obtuse to acute, acuminate, or rarely bifid. Inflorescences axillary and/or terminal, paniculate, thyriform, corymbiform, or cymose, pyramidal to rounded, 5–100 cm, branched to 2–5 orders with higher order axes dichotomous or often scorpioid, hirtellous, strigillose, or glabrous, pedunculate; bracts lanceolate to triangular, 0.8–3 mm; pedicels to 1.5 mm. Flowers sessile to pedicellate in dichotomous to scorpioid, lax to somewhat congested cymes. Calyx glabrous to densely puberulent; hypanthium portion turbinate to ellipsoid, 0.8–2 mm; limb deeply lobed; lobes triangular, 0.4–1 mm. Corolla pale purple, grayish pink, lilac, or grayish white, funnelform, outside densely mealy puberulent or mealy tomentulose; tube (5–)7–10(–17) × 2–6 mm, without slits; lobes broadly triangular to ovate, 1–2 mm, acute. Fruit globose, 4–7 × 4–7 mm, glabrescent, drying gray to yellow; pyrenes concavo-convex to plano-convex. Fl. May–Oct, fr. Jul–Dec.

Forests, forest margins, thickets in ravines and on mountain slopes; 200–2000 m. Anhui, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hainan, Henan, Hubei, Jiangsu, Jiangxi, Shandong, Shanxi, Sichuan, Taiwan, Yunnan, Zhejiang [Bangladesh, Bhutan, Borneo, Cambodia, India, Indonesia, Japan, N Korea, Laos, Malaysia, Myanmar, Nepal, Philippines, Thailand, Vietnam; also occasionally cultivated, and naturalized in United States (Florida) and perhaps Sri Lanka].

*Paederia foetida* is naturalized in a few places around the world and apparently quite weedy wherever it grows; in particular, it has been reported as an adventive and sometimes a problem weed in Florida, where it is called “skunk vine.”

Puff (Opera Bot. Belg. 3: 207–292. 1991) substantially changed and clarified the application of this name; see the discussion under the genus above. *Paederia foetida* as circumscribed by Puff (and here) is widespread and morphologically widely variable but with continuous morphological variation, as documented in detail (loc. cit.: 223–224, f. 4, f. 5). W. C. Ko (in FRPS 71(2): 118–119. 1999) recognized two varieties within this species (treated as *P. scandens*), with the stems and leaves glabrous or subglabrous in var. *scandens* and subglabrous to pubescent in var. *tomentosa*; Ko reported var. *scandens* from throughout

the range of this species in China and var. *tomentosa* only from “Jiangxi, Guangdong, Hong Kong, Hainan, Guangxi, Yunnan.” Puff synonymized these based on his conclusion that pubescence varies continuously within this species and thus does not distinguish separate evolutionary lineages.

Puff synonymized *Paederia stenophylla* with *P. foetida*, and this name is provisionally listed in synonymy here. The name *P. stenophylla* seems to have been applied by W. C. Ko (loc. cit.: 115) at least in part to plants that Puff treated as *P. pertomentosa* rather than *P. foetida*, and Puff reported that he did not see the type of *P. stenophylla*; this situation may deserve re-consideration, but that work is outside the scope of this current project.

The name *Paederia dunniana* from Guizhou was apparently overlooked by Puff; this was reported by Lauener and Ferguson (Notes Roy. Bot. Gard. Edinburgh 32: 112. 1972) to be a synonym of “*P. scandens*,” which corresponds to *P. foetida* here, and this name is accordingly synonymized here provisionally.

**4. *Paederia lanuginosa*** Wallich, Pl. Asiat. Rar. 2: 52. 1831.

绒毛鸡矢藤 *rong mao ji shi teng*

*Hondbeseion lanuginosum* (Wallich) Kuntze; *Paederia macrocarpa* Wallich.

Vines, to 12 m; stems densely tomentose to glabrescent, drying dark brown. Leaves opposite; petiole 3.5–12 cm, densely tomentose; blade elliptic to oblong-elliptic, 8–20 × 4.5–15 cm, adaxially sparsely to moderately strigillose with pubescence denser on midrib, abaxially densely tomentulose, base cordate to subrounded, margins flat, apex acuminate; stipules caducous often by fragmentation, triangular, 4.5–8.5 × 2.3–5.5 mm, acute to bifid. Inflorescences axillary on main stems and/or terminal on lateral stems, paniculate, densely tomentulose, pedunculate. Flowers subsessile in small heads. Calyx densely tomentulose; hypanthium portion turbinate to subglobose, 1.6–2.5 mm; limb deeply lobed; lobes triangular to suborbicular, 1–1.4 mm. Corolla pale green, dull white, pink, reddish purple, or dark purple, funnelform, outside densely tomentulose; tube 15–17.5 × 3.5–4.5 mm, with slits at base; lobes broadly triangular, 2.7–4 mm, acuminate, marginally crisped. Fruit oblong-elliptic, laterally flattened, 9–15 × 7–9 mm, subglabrous, drying brown; pyrenes elliptic to ovate in outline, flattened, marginal wing 1–2 mm wide. Fl. Jun–Jul, fr. Aug–Feb.

Open forests or thickets, twining on other shrubs and small trees; sea level to 1900 m. Yunnan [Myanmar, Thailand].

Puff (Opera Bot. Belg. 3: 207–292. 1991) noted that this species has the largest leaves of the genus, as well as notably large flowers and fruit, and sometimes has “conspicuously fissured bark” that is also distinctive. W. C. Ko (in FRPS 71(2): 114. 1999) described the corolla lobes as 3-lobed, but this has not been mentioned by any other authors.

**5. *Paederia pertomentosa*** Merrill ex H. L. Li, J. Arnold Arbor. 24: 458. 1943.

白毛鸡矢藤 *bai mao ji shi teng*

Vines or clambering subshrubs, to 5 m; stems densely pilosulous to tomentulose, when dry dark straw-yellow. Leaves opposite; petiole 1–5 cm, densely pilosulous or hirtellous and/or tomentulose; blade drying papery, ovate-elliptic, lanceolate-oblong, or oblong-elliptic, 5–15 × 2–6 cm, adaxially moder-

ately to densely pilosulous to strigillose with pubescence denser along midrib, abaxially densely white tomentulose, base obtuse, rounded, truncate, or cordulate, margins flat, apex acute to acuminate; secondary veins 6–8 pairs; stipules generally persistent, triangular, 2–3.5 mm, acute to weakly acuminate. Inflorescences axillary and/or terminal, spiciform to paniculate, cylindrical to narrowly pyramidal, 15–50 cm, branched to 1–3 orders with ultimate axes often very short, densely pilosulous to tomentulose, pedunculate; bracts triangular, 1–4 mm. Flowers sessile or subsessile in congested cymes or small heads. Calyx densely pilosulous to tomentose; hypanthium portion turbinate to ellipsoid, ca. 1 mm; limb lobed nearly to base; lobes triangular, 0.6–1 mm. Corolla lilac, grayish pink, or grayish purple, tubular-funnelform, outside densely papillose to puberulent; tube 5–8 × 2–3 mm, without slits; lobes ovate to triangular, 1–1.5 mm, acute, margins flat to crisped. Fruit globose to subglobose, 4–7 × 4–7 mm, glabrous, drying straw-yellow; pyrenes plano-convex or concavo-convex. Fl. May–Aug, fr. Jul–Nov.

• Forests, thickets, often on limestone; 200–1400 m. Fujian, Guangdong, Guangxi, Hainan, Hunan, Jiangxi.

**6. *Paederia praetermissa*** Puff, Opera Bot. Belg. 3: 273. 1991.

奇异鸡矢藤 qi yi ji shi teng

Vines, to 5 m; stems densely hirsute to hirtellous becoming glabrescent, drying brownish gray. Leaves opposite; petiole 1.5–8 cm, moderately to densely hirsute, hirtellous, or pilosulous; blade drying papery to subleathery, ovate-elliptic or lanceolate, 6–22 × 3.5–12 cm, adaxially sparsely hirtellous or hispidulous to glabrescent, abaxially densely pilose to hirtellous or tomentose, base cordate to cordate, margins flat, apex acute to acuminate; secondary veins ca. 8 pairs; stipules caducous, triangular to lanceolate, 9–25 × 5–13 mm. Inflorescences terminal on lateral stems and/or axillary on main stems, paniculate, pyramidal to cylindrical, 8–20 cm, branched to 2–4 orders, densely hirsute to hirtellous or pilosulous, pedunculate; bracts linear to triangular. Flowers subsessile. Calyx densely pilosulous to hirtellous; hypanthium portion ellipsoid, 1–1.4 mm; limb lobed for ca. 1/2; lobes narrowly lanceolate or linear-lanceolate, 0.5–0.8 mm. Corolla grayish purple to pink, funnelform, outside densely puberulent or scabridulous; tube 4.5–9 × 1.2–1.5 mm, without slits; lobes ovate-elliptic, 1.5–2.5 mm, acute to minutely trifid, margins crisped. Fruit brown, ellipsoid to ovoid, laterally somewhat compressed, 5–7 × 5–6 mm, sparsely to moderately pilosulous to hirtellous to glabrescent; pyrenes ovate to elliptic in outline, flattened, marginal wing 0.8–1 mm wide. Fl. Jun–Jul or Oct–Nov, fr. Dec–Jan.

Sparse forests or thickets; 600–1300 m. Yunnan [Myanmar, Thailand, ?Vietnam].

**7. *Paederia spectatissima*** H. Li, Novon 9: 220. 1999.

云桂鸡矢藤 yun gui ji shi teng

Vines, twining, to 12 m; stems glabrous, drying dark red then grayish brown. Leaves opposite; petiole 1–4 cm, glabrous; blade drying leathery to papery, ovate-elliptic to elliptic, 6–12 × 3–6 cm, glabrous on both surfaces, base cuneate to obtuse, margins flat, apex acuminate with tip usually prolonged; secondary veins 6–10 pairs; stipules persistent or caducous, broadly trian-

gular, 1–1.5 mm, obtuse to shortly acuminate. Inflorescences axillary and/or terminal, paniculate, pyramidal to cylindrical, 20–100 cm, branched to 6–10 orders, papillose, puberulent, or glabrescent, pedunculate; bracts triangular, 1–2 mm. Flowers sessile or subsessile. Calyx densely puberulent; hypanthium portion ellipsoid, 1–1.5 mm; limb 0.8–1 mm, lobed for ca. 1/2; lobes triangular, 0.3–0.6 mm. Corolla greenish to purplish white, funnelform, densely papillose-puberulent to scabrid-papillose outside; tube 5–8 × 2.6–3.7 mm, with slits at base; lobes triangular, 1.7–2.4 mm, acute, margins often crisped. Fruit orbicular, flattened laterally, 10–11 × 10–11 mm, puberulent, drying dark gray; pyrenes orbicular in outline, flattened, papery, marginal wing 4–4.5 mm wide. Fl. and fr. Jun–Oct.

Open forests; 800–1000 m. Guangxi, Yunnan (Pingbian) [Vietnam].

W. C. Ko (in FRPS 71(2): 112. 1999) attributed this name to Puff (Opera Bot. Belg. 3: 285. 1991). However, Puff attributed this name to Li in unpublished work and provided no Latin diagnosis or designation of a type, so this name was not validly published by him. Li cited only three collections in her article in Novon and none were specimens cited by Puff, so the specimens cited by Puff do not actually seem to be paratypes as has been suggested.

**8. *Paederia stenobotrya*** Merrill, Lingnan Sci. J. 11: 57. 1932.

狭序鸡矢藤 xia xu ji shi teng

Vines, to 3 m; stems densely hirtellous, hirsute-hirtellous, or glabrescent, drying dark yellow. Leaves opposite; petiole 2.5–7 cm, densely hirtellous to tomentose-hirtellous; blade drying papery, ovate, oblong-ovate, or elliptic-ovate, 6–17 × 3–11 cm, adaxially sparsely to moderately scabrid to hirtellous, abaxially hirtellous, pilosulous, or pilose with pubescence denser along veins, base cordate, cordulate, truncate, or rarely acute, margins flat, apex acute to acuminate; secondary veins 5–8 pairs; stipules generally caducous, triangular, 4–10 mm, acute. Inflorescences axillary and/or terminal, spiciform to narrowly paniculate, cylindrical to narrowly pyramidal, 7–30 cm, branched to 1–3 orders, densely hirtellous to hirtellous-tomentose, pedunculate; bracts triangular, 1–2 mm. Flowers sessile in congested cymes or small heads. Calyx densely hirtellous; hypanthium portion turbinate to ellipsoid, 1–1.5 mm; limb lobed nearly to base; lobes subulate to narrowly triangular, 1–2 mm. Corolla funnelform, outside densely hirtellous to tomentulose; tube 5–6 × 2.5–3 mm, without slits; lobes ovate, 1–2 mm. Fruit globose, 5–6 × 5–6 mm, glabrous, drying orange-yellow; pyrenes plano-convex to concavo-convex. Fl. Jun, fr. Jun–Nov.

• Broad-leaved forests on hill slopes; 400–900 m. Fujian, Guangdong, Hainan.

Puff (Opera Bot. Belg. 3: 207–292. 1991) reported this species only from Hainan, but W. C. Ko (in FRPS 71(2): 117. 1999) reported it also from Guangdong and Fl. Fujian. (5: 185. 1993) from Fujian.

**9. *Paederia yunnanensis*** (H. Léveillé) Rehder, J. Arnold Arb. 18: 249. 1937.

云南鸡矢藤 yun nan ji shi teng

*Cynanchum yunnanense* H. Léveillé, Cat. Pl. Yun-Nan, 13. 1915; *Paederia bodinieri* H. Léveillé (1914–1915), not H.

Léveillé (1914); *P. rehderiana* Handel-Mazzetti; *P. tomentosa* Blume var. *purpureocaerulea* H. Léveillé & Vaniot.

Vines, to 7 m; stems densely tomentulose and/or hirtellous becoming glabrescent, drying brown. Leaves opposite; petiole 2–7.5 cm, densely tomentulose and/or pilosulous; blade drying submembranous to papery, ovate, lanceolate, or lanceolate-elliptic, 6–16 × 3–12 cm, adaxially densely strigillose, pilosulous, or scabrous, abaxially densely tomentose to hirtellous, base cordulate to deeply cordate or rarely obtuse, margins flat, apex acute or acuminate; secondary veins 6–8 pairs; stipules generally persistent, lanceolate-triangular to narrowly triangular, 4–15 mm, acute to acuminate or rarely bifid. Inflorescences axillary on main stems and/or terminal on lateral stems, paniculate, cylindrical to narrowly pyramidal, 6–25 cm, branched to 1–3 orders, densely tomentulose to hirtellous or pilosulous, pedunculate or sometimes apparently sessile with basal axes sub-

tended by reduced leaves (or leaflike bracts); bracts linear to narrowly triangular or deeply bilobed, 1.5–6 mm. Flowers sessile and subsessile in congested to subcapitate cymes (sometimes appearing pedicellate when axes of cymes develop later). Calyx with hypanthium portion ellipsoid, 1–1.5 mm, glabrous to puberulent; limb lobed nearly to base; lobes oblong-lanceolate to narrowly triangular, 0.5–1.7 mm, sparsely to densely puberulent, strigillose, or hirtellous. Corolla pale green, pink, reddish purple, or dark purple, tubular-funnelform, outside densely mealy puberulent; tube 5–10.5 × 2.5–5 mm, without slits; lobes broadly triangular, 1–2.5 mm, obtuse to acute, margins crisped. Fruit ovoid, laterally compressed, 6–9 × 5–7 mm, glabrescent, drying brown; pyrenes ovate in outline, flattened, papillose-puberulent, marginal wing ca. 1 mm wide. Fl. Jun–Oct, fr. Jul–Dec.

Forest margins in valleys; 300–3000 m. Guangxi, Guizhou, Sichuan, Yunnan [Vietnam].

## 67. PAVETTA Linnaeus, Sp. Pl. 1: 110. 1753.

大沙叶属 da sha ye shu

Chen Tao (陈涛); Charlotte M. Taylor

*Pavate* Adanson.

Shrubs, small trees, or infrequently subshrubs, unarmed. Raphides absent. Leaves opposite or rarely whorled, usually with bacterial nodules and/or domatia in abaxial vein axils; stipules generally persistent, shortly united around stem, triangular, often aristate, often sericeous adaxially. Inflorescences terminal on principal stems, terminal on reduced lateral stems and appearing axillary, or rarely truly axillary, cymose to corymbiform, many flowered, sessile to pedunculate, bracteate with bracts often fused in pairs. Flowers pedicellate or sessile, bisexual, monomorphic, fragrant, with secondary pollen presentation. Calyx limb truncate or 4(or 5)-lobed. Corolla white to cream [or rarely red], salverform with tube slender, inside glabrous or pubescent in throat; lobes 4, convolute in bud. Stamens 4(or 5), inserted in corolla throat, exerted or included; filaments short; anthers dorsifixed near base, sometimes becoming twisted with age. Ovary 2-celled, ovules 1(or 2) in each cell on axile placentas attached at top of septum; stigma restricted to terminal portion of thickened style, very shortly 2-lobed with lobes erect, exerted. Fruit black and often shiny or infrequently white, red, or blue, drupaceous, thinly fleshy, globose to ovoid, with calyx limb persistent or deciduous; pyrenes 2, 1-celled, each with 1 seed, plano-convex or concavo-convex, papery; seeds medium-sized, ellipsoid, discoid, or plano-convex; testa membranous; endosperm corneous; embryo dorsal, curved; cotyledons leaflike; radicle hypogeous.

About 400 species: paleotropical, widespread in Africa, tropical Asia, Australia, and Pacific islands, apparently absent from Madagascar; six species (two endemic) in China.

Secondary pollen presentation is found in *Pavetta* (De Block, Opera Bot. Belg. 9: 1–218. 1998; Rout & Deb, Bull. Bot. Surv. India 41: 1–182. 1999). Rout and Deb (loc. cit.) reported synchronous flowering in the Indian species of *Pavetta*. W. C. Ko (in FRPS 71(2): 25. 1999) described the filaments as ranging from short to prolonged, but that latter condition has not been reported by other authors in *Pavetta* or *Ixora*. Ko also described the placentas as sometimes attached to the middle of the septum, but Bremekamp (Repert. Spec. Nov. Regni Veg. 37: 2–11. 1934) said this is incorrect and an old mistake in *Pavetta*.

Bremekamp (loc. cit.; Repert. Spec. Nov. Regni Veg. 47: 12–28. 1939) recognized three subgenera of *Pavetta*; the Chinese species all belong to his *P.* subg. *Pavetta*, and the other two subgenera are restricted to Africa.

Bremekamp, in general, distinguished *Pavetta* species more narrowly than many other authors; for example, he (loc. cit. 1934; loc. cit. 1939) reported 42 species for the Indian subcontinent, while Rout and Deb (loc. cit.) recognized only 25 species with the rest of Bremekamp's names synonymized. W. C. Ko (loc. cit.: 25–30) followed Bremekamp (loc. cit. 1934) closely; in contrast, all the morphological variation found among the Chinese species falls well within Rout and Deb's (loc. cit.: 114–136) circumscription of *P. indica* Linnaeus. Bremekamp (loc. cit. 1939) noted that the E Chinese plants previously identified as *P. indica* were included by him in *P. hongkongensis*.

In particular, Bremekamp (loc. cit. 1934) considered stem characters to be informative taxonomically in *Pavetta*, particularly green vs. corky-barked stems, but Rout and Deb (loc. cit.) concluded that these represent different developmental stages rather than differences between species. Bremekamp (loc. cit. 1934) considered the arrangement of the bacterial nodules in the leaves to be taxonomically informative for distinguishing infrageneric groups and sometimes species, but Rout and Deb (loc. cit., as “bacterial leaf-galls”) found them to have no taxonomic value and concluded that the nodules vary in shape and number among different leaves on a plant as well as between plants of the same and different species. Bremekamp (loc. cit. 1934) distinguished several species based on leaf shape and size, but Rout and Deb (loc. cit.) included notable variation in leaf size and shape, from relatively very narrow to quite broad, within individual species of *Pavetta*; Bridson and Verdcourt (Fl. Trop. E. Africa, Rub. (Pt. 2), 619–686. 1988) circumscribed several species similarly to Rout and Deb. Bremekamp (loc. cit. 1934) considered several species of *Pavetta* to have

axillary inflorescences, as did Rout and Deb (loc. cit.), but Bridson and Verdcourt (loc. cit.) considered the inflorescences of the African species at least to be terminal on reduced lateral short shoots, as found in a number of Rubiaceae genera, and to appear axillary but not be truly axillary. Bremekamp (loc. cit. 1934) gave much attention to the arrangement of the inflorescence bracts in *Pavetta*; his descriptions apply to bracts but not bracteoles, so his characterizations may be misinterpreted if not observed carefully. Bremekamp noted (loc. cit. 1934) that occasional flowers with 5 calyx and corolla lobes are found in most *Pavetta* species, but the majority of flowers are always 4-merous and the genus best considered to be 4-merous; a similar situation is found in other Rubiaceae genera.

The treatment here follows that of W. C. Ko (loc. cit.), for reference. The key here has been augmented with characters from the descriptions, and the descriptions have been augmented with characters from the available specimens cited by Bremekamp.

- 1a. Flowering branches not green.
- 2a. Leaf blade elliptic-oblong to obovate-oblong, 9–18 × 3–3.5 cm, drying membranous, adaxially glabrous, abaxially villosulous, with secondary veins 6–8 pairs ..... 1. *P. arenosa*
- 2b. Leaf blade elliptic or elliptic-lanceolate, 8–15 × 4–9 cm, drying thickly papery, adaxially scabrous, abaxially tomentose, with secondary veins 10–12 pairs ..... 6. *P. tomentosa*
- 1b. Flowering branches green or almost green, sometimes becoming black when dry.
- 3a. Leaf blade scabrous on both surfaces on midrib; style ca. 38 mm ..... 4. *P. scabrifolia*
- 3b. Leaf blade smooth, glabrous, or variously pubescent but not scabrous on both surfaces; style 35 mm or shorter.
- 4a. Flowering branches and hypanthium portion of flower glabrous; leaf blade elliptic-oblong to elliptic-obovate, adaxially glabrous, abaxially subglabrous or pubescent along midrib and in axils of veins ..... 2. *P. hongkongensis*
- 4b. Flowering branches and hypanthium portion of flower puberulent to pilosulous or glabrescent; leaf blade narrowly obovate, lanceolate, narrowly elliptic, or oblanceolate, adaxially glabrescent, abaxially puberulent to pilosulous at least on veins.
- 5a. Leaf blade narrowly obovate or lanceolate, 9–13 × 3.5–4.7 cm, with secondary veins 6–8 pairs ..... 3. *P. polyantha*
- 5b. Leaf blade narrowly elliptic or oblanceolate, 10–13 × ca. 5 cm, with secondary lateral veins 6 or 7 pairs ..... 5. *P. swatowica*

**1. *Pavetta arenosa*** Loureiro, Fl. Cochinch. 1: 73. 1790, emend. Bremekamp, Repert. Spec. Nov. Regni Veg. 47: 23. 1939.

大沙叶 da sha ye

?*Pavetta sinica* Miquel.

Shrubs, 1–3 m tall; branches compressed, puberulent to glabrous. Petiole 5–20 mm, glabrous to sparsely pilosulous; leaf blade drying membranous, elliptic-oblong to obovate-oblong, 9–18 × 3–3.5 cm, usually with bacterial nodules, adaxially glabrous and somewhat shiny, abaxially sparsely to densely villosulous, base cuneate to acute, apex acuminate; secondary veins 6–8 pairs; stipules broadly ovate-triangular, 2–12 mm, pilosulous to glabrous, acute to obtuse. Inflorescence terminal, 9–11 × ca. 15 cm, pilosulous to glabrescent; peduncle 2.5–4 cm; pedicels 10–12 mm. Flowers pedicellate. Calyx with hypanthium portion ellipsoid, ca. 1 mm, densely pilosulous; limb ca. 1 mm, sparsely pilosulous to glabrescent, lobed for up to 1/2. Corolla white, outside glabrous; tube 10–18 mm, bearded in throat; lobes narrowly oblong, 3–5 mm, obtuse. Style 25–30 mm. Drupe globose, 6–7 mm in diam., glabrous, calyx limb persistent. Fl. Apr–May, fr. Oct–Nov.

Sparse forests at low elevations. Guangdong, Guangxi, Hainan [Vietnam].

Plants with calyx tube glabrous from Guangxi have been called *Pavetta arenosa* f. *glabrituba* Chun & F. C. How ex W. C. Ko (Fl. Hainan. 3: 583. 1974). This may be best synonymized here, pending further study.

In his revision of *Pavetta* Bremekamp (Repert. Spec. Nov. Regni Veg. 37: 104. 1934) described *P. hongkongensis* for the common Chinese plants and considered *P. arenosa* a dubious name that he tenta-

tively referred to *Tarenna*, but later (Bremekamp, Repert. Spec. Nov. Regni Veg. 47: 12–28. 1939) he reported that Merrill had differed with his conclusion, had examined the type of *P. arenosa*, and had sent him information that persuaded him to apply this latter name to Chinese plants. The protologue provided very limited information, which was significantly expanded by Bremekamp, thus the annotation here of this as an emended description. Bremekamp here also stated, without citing any individual specimens or contrasting the species, that both *P. arenosa* and *P. hongkongensis* are found commonly in China. W. C. Ko (in FRPS 71(2): 26. 1999) separated these based on the color of their flowering branches: green or almost green in *P. hongkongensis* vs. not green in *P. arenosa*; however, this is a character that Rout and Deb (Bull. Bot. Surv. India 41: 1–182. 1999) tested empirically and found to be variable within all Indian species of *Pavetta* and, thus, of questionable use there and elsewhere.

W. C. Ko (loc. cit.: 28) cited the name *Pavetta sinica* as a synonym of *P. arenosa*, but the source for this synonymy is unknown to us. Bremekamp specifically excluded this name from synonymy in his circumscription of *P. arenosa*, though apparently Merrill did synonymize it here (Lingnan Sci. J. 15: 17. 1936). Bremekamp treated *P. sinica* as a species distinct from *P. arenosa* and *P. hongkongensis* and considered it most closely related to *P. tomentosa*. Bremekamp saw its type and described the corolla tube as 17 mm, which does not agree with the descriptions presented by W. C. Ko (loc. cit.: 27–28) for either *P. arenosa* or *P. hongkongensis*. However, the specimens cited for *P. arenosa* by Bremekamp (loc. cit. 1939) have corolla tubes 10–18 mm, so Bremekamp's description of *P. sinica* is easily included in his circumscription of *P. arenosa*.

**2. *Pavetta hongkongensis*** Bremekamp, Repert. Spec. Nov. Regni Veg. 37: 104. 1934.

香港大沙叶 xiang gang da sha ye

*Tarenna kwangsiensis* Handel-Mazzetti.

Shrubs or small trees, 1–4 m tall; branches compressed, glabrous, green or almost green, often drying blackened. Petiole 1–2 cm, glabrous; leaf blade drying membranous, elliptic-oblong to elliptic-oblancheolate, 8–15 × 3–6.5 cm, often with bacterial nodules, adaxially glabrous, abaxially glabrous, glabrescent, or pubescent along midrib, base cuneate to acute, apex acuminate to acute; secondary veins 6 or 7 pairs; stipules broadly ovate-triangular, 1–3 mm, glabrous, acute to shortly aristate. Inflorescences terminal on lateral branches, laxly corymbose, 7–9 × 7–15 cm, many flowered, glabrous; peduncle 1–2 cm; pedicels 3–6 mm. Flowers pedicellate. Calyx with hypanthium portion ellipsoid, ca. 1 mm, glabrous; limb 0.5–1.5 mm, glabrous, shallowly lobed. Corolla white, outside glabrous; tube 12–19 mm, inside pilose at throat; lobes narrowly triangular-oblong, 5–7 mm, acute to obtuse. Style ca. 35 mm. Drupes globose, 6–7 mm, pilosulous to glabrous, calyx limb persistent. Fl. Mar–Jul, fr. Jul–Nov.

Thickets; 200–1300 m. Guangdong, Guangxi, Hainan, Yunnan [Vietnam].

Bremekamp noted in his description of this species that it comprises the Chinese plants previously treated as *Pavetta indica* by at least some authors.

**3. *Pavetta polyantha*** (J. D. Hooker) R. Brown ex Bremekamp, Repert. Spec. Nov. Regni Veg. 37: 103. 1934.

多花大沙叶 duo hua da sha ye

*Pavetta indica* Linnaeus var. *polyantha* J. D. Hooker, Fl. Brit. India 3: 150. 1880.

Shrubs, 1–3 m tall; young branches compressed to subterete, glabrescent or puberulent. Petiole 10–30 mm, puberulent; leaf blade drying membranous, narrowly obovate or lanceolate, 9–13 × 3.5–4.7 cm, with several bacterial nodules, adaxially glabrescent, abaxially puberulent at least along veins, base cuneate or acute, apex acuminate; secondary veins 6–8 pairs; stipules ovate-triangular, 5–7 mm, puberulent or glabrescent, shortly aristate. Inflorescences terminal on developed branches, laxly corymbose, ca. 9 × 15 cm, many flowered, strigillose to glabrescent; peduncle 1.5–2 cm; pedicels 3–5 mm. Flowers pedicellate. Calyx with hypanthium portion ellipsoid, 1–1.2 mm, densely strigillose; limb 1–1.5 mm, sparsely strigillose, lobed for up to 1/2. Corolla white, outside glabrous; tube 19–22 mm, bearded in throat; lobes narrowly ligulate, 6–7 mm, obtuse to rounded. Style ca. 30 mm. Drupe globose, ca. 8 mm, glabrous. Fl. Apr–Jun.

Sparse forests, streamsides; 900–1200 m. Guangdong, Guangxi, Guizhou, Yunnan [Bhutan, India, Indonesia, Myanmar, Philippines].

Rout and Deb (Bull. Bot. Surv. India 41: 122–128. 1999) included *Pavetta polyantha* within their circumscription of *P. indica* var. *glabrescens* (Kurz) Deb & Rout. The name *P. polyantha* is based on a Wallich specimen from Assam.

**4. *Pavetta scabrifolia*** Bremekamp, Repert. Spec. Nov. Regni Veg. 37: 100. 1934.

糙叶大沙叶 cao ye da sha ye

Shrubs, height not noted; branches subcompressed to angled, puberulent to pilosulous, green or almost green. Petiole

1–1.5 cm, pubescent; leaf blade drying membranous, lanceolate, 13–16 × 3.2–4.4 cm, adaxially subglabrous except scabrous along midrib, abaxially scabrous, base cuneate, apex caudate; secondary veins 5 or 6 pairs; stipules broadly triangular, cuspidate. Inflorescence terminal on branches with 1 long internode and several short internodes, laxly corymbose, pubescent. Calyx subglabrous; limb ca. 1 mm, lobed for ca. 1/2. Corolla white; tube ca. 17 mm, glabrous inside; lobes narrowly oblong-triangular, ca. 5.5 mm. Style ca. 38 mm. Drupes subglobose, ca. 5 mm in diam., glabrescent, calyx limb persistent. Fl. May–Jun.

• Sparse forests, ditch sides; 900–1300 m. Yunnan.

**5. *Pavetta swatowica*** Bremekamp, Repert. Spec. Nov. Regni Veg. 37: 104. 1934.

汕头大沙叶 shan tou da sha ye

Shrubs, height not noted; branches compressed to terete, pilosulous, green or almost green becoming grayish or blackened when dry. Petiole 1–2 cm, pilosulous; leaf blade drying thinly papery or submembranous, narrowly elliptic or oblanceolate, 10–13 × ca. 5 cm, adaxially glabrescent, abaxially pilosulous, base cuneate, apex long acuminate; secondary veins 6 or 7 pairs; stipules ovate-triangular, ca. 5 mm, puberulent, shortly cuspidate. Inflorescence terminal on developed branches, laxly corymbose, many flowered, pubescent; peduncles 2–3 cm; pedicels 4–6 mm. Flowers pedicellate. Calyx with hypanthium subglobose, densely grayish pilosulous or sericeous; limb shallowly lobed. Corolla white, outside glabrous; tube ca. 14 mm, sparsely tomentose inside; lobes narrowly oblong or oblong-lanceolate, ca. 6 mm. Style ca. 35 mm. Drupes unknown.

• Sparse forests, streamsides. Guangdong.

This name was incorrectly spelled by W. C. Ko (in FRPS 71(2): 26–27. 1999) as "*Pavetta swatouica*." Ko's description, perhaps following that of Bremekamp, described the stipules as caducous, although the stipules are otherwise considered persistent in *Pavetta* by other authors, including Bremekamp.

**6. *Pavetta tomentosa*** Roxburgh ex Smith in Rees, Cycl. 26: *Pavetta* no. 2. 1814.

绒毛大沙叶 rong mao da sha ye

*Ixora tomentosa* (Roxburgh ex Smith) Roxburgh; *I. tomentosa* var. *roxburghii* Kurz; *Pavetta indica* Linnaeus var. *tomentosa* (Roxburgh ex Smith) J. D. Hooker; *P. tomentosa* var. *roxburghii* (Kurz) Bremekamp.

Shrubs or small trees, height not noted; branches tomentose. Petiole 1–3 cm, tomentose; blade drying thickly papery and blackening, elliptic or elliptic-lanceolate, 8–15 × 4–9 cm, scabrous adaxially, tomentose abaxially, base acute, apex acute or acuminate; secondary veins 10–12, with foveolate and/or pubescent domatia; stipules ovate-triangular, 6–8 mm, tomentose, aristate. Inflorescences terminal on branches with 1 or 2 internodes, laxly corymbose, 5–10 × 5–25 cm, densely tomentose, pedunculate; peduncle 0.5–1.5 cm; pedicels 4–8 mm. Flowers pedicellate. Calyx densely tomentose; hypanthium portion ellipsoid, ca. 1 mm; limb ca. 0.5 mm, denticulate to lobed. Corolla white, outside glabrous; tube (6.2–)8–12 mm, sparsely pilose inside; lobes narrowly oblong, 4.6–7 mm, acute. Style 24–33

mm. Drupes globose, ca. 5 mm, tomentulose. Fl. and fr. Jul–Sep.

Tropical rain forests; ca. 1000 m. Yunnan (Menghai) [India, Malaysia, Myanmar, Nepal, Pakistan, Thailand, Vietnam].

Rout and Deb (Bull. Bot. Surv. India 41: 128–136. 1999) treated this species as *Pavetta indica* var. *tomentosa*. Bremekamp (Repert. Spec. Nov. Regni Veg. 37: 113–114. 1934) and Rout and Deb described the corolla tubes as 8–12 mm, but W. C. Ko (in FRPS 71(2): 28. 1999) gave the minimum measurement as 6.2 mm.

## 68. PENTAS Bentham, Bot. Mag. 70: t. 4086. 1844.

五星花属 wu xing hua shu

Chen Tao (陈涛); Charlotte M. Taylor

Perennial herbs or subshrubs, unarmed. Raphides present. Leaves opposite or whorled, without domatia; stipules persistent, interpetiolar and sometimes fused to petioles, triangular to truncate, multifid or setaceous, with segments often gland-tipped. Inflorescences terminal, cymose, paniculate, or corymbiform, several to many flowered, subsessile to pedunculate, bracteate. Flowers subsessile, bisexual, distylous [or rarely tristylous]. Calyx limb deeply (4 or)5-lobed; lobes sometimes slightly to strongly unequal on an individual flower [sometimes with calycophylls]. Corolla white, pink, red, purple, or yellow, salverform to narrowly tubular with tube prolonged and usually expanded at throat, inside villous in throat; lobes (4 or)5(or 6), valvate in bud. Stamens (4 or)5(or 6), inserted in corolla just below throat, included in long-styled, mid-styled, and homostylous forms or exserted in short-styled form; filaments short to well developed; anthers dorsifixed. Ovary 2-celled, ovules numerous in each cell on axile placentas; stigmas 2, linear, included in short-styled and mid-styled forms or exserted in long-styled and monomorphic forms. Fruit capsular, subglobose to ovoid or obovoid with apex often elongated into conical beak, membranous or leathery, loculicidally dehiscent through apical portion, with calyx limb persistent; seeds numerous, small, angled to subglobose.

About 50 species: widespread in Africa and Madagascar, one species cultivated worldwide; one species (introduced) in China.

**1. *Pentas lanceolata*** (Forsskål) Deflers, Voy. Yemen, 142. 1889.

五星花 wu xing hua

*Ophiorrhiza lanceolata* Forsskål, Fl. Aegypt.-Arab. 42. 1775; *Pentas carnea* Bentham.

Subshrubs, 30–70 cm tall; branches quadrangular, moderately to densely pilosulous to villous often becoming glabrescent with age. Leaves opposite; petiole 0.5–3 cm, pilosulous to villous; blade drying papery, oblong-lanceolate to ovate, 5–14 × 2–5.5 cm, adaxially scabrous or villous to glabrescent, abaxially densely villous or hirtellous at least along principal veins, base cuneate to obtuse, apex acute or shortly acuminate; secondary veins 8–10 pairs; stipules truncate to broadly rounded, 1.5–2 mm, villous, bristles 1–5, 1–4 mm. Inflorescence densely pilosulous to villous; peduncle 3–12 mm; branched portion congested-cymose often becoming lax, 1.5–4 × 1.5–4 cm; bracts narrowly triangular to linear, 0.5–1.5 mm. Flowers sessile or

subsessile, distylous. Calyx densely hirtellous or villous; ovary portion subglobose to obovoid, ca. 1 mm; limb deeply lobed; lobes narrowly oblanceolate to elliptic or narrowly spatulate, 2–8 mm, usually unequal on an individual flower with nearly this entire size range found on some flowers, acute. Corolla pale purple to pink, red, white, or yellow, salverform, sparsely hirtellous to glabrescent outside; tube slender except rather abruptly swollen in throat in long-styled form (around stamens), 17–20 mm, densely barbate in throat; lobes elliptic or oblong-lanceolate, 3–4 mm, acute to obtuse. Capsules obovoid, 4–6 × 4–6 mm, stiffly papery to woody, with beak 1–2 mm tall; seeds 0.5–1 mm. Fl. Jul–Sep.

Cultivated in gardens in S China; sea level to 1500 m. Fujian, Guangdong [native to Africa (Democratic Republic of Congo, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, Uganda); commonly cultivated worldwide].

Cultivated plants of *Pentas lanceolata* are usually all long-styled and usually do not set fruit. They are variable in flower color, and new varieties and colors continue to be developed.

## 69. PERTUSADINA Ridsdale, Blumea 24: 353. 1979.

槽裂木属 cao lie mu shu

Chen Tao (陈涛); Charlotte M. Taylor

Trees or shrubs, unarmed; trunk often fluted or latticed. Raphides absent. Leaves opposite, usually with domatia; stipules caducous, triangular, entire or shortly bifid. Inflorescences axillary or terminal, capitate with 1–5 globose heads in fascicles or cymes, pedunculate, bracteate; bracteoles spatulate to linear-spatulate. Flowers sessile, bisexual, monomorphic. Calyx lobes 5, spatulate, obtuse. Corolla yellow, salverform to slenderly funnelliform, inside glabrous; lobes 5, valvate or with apices subimbricate in bud. Stamens 5, inserted in upper part of corolla tube, exserted; filaments short; anthers basifixed. Ovary 2-celled, ovules 4–10 in each cell, pendulous on axile placentas attached to upper third of septum; stigma globose to obovoidal, exserted. Fruiting heads globose. Fruit capsular, obconic, septicidally then loculicidally dehiscent into 2 or 4 valves from base to apex with valves separating also from persistent or tardily deciduous septum, cartilaginous to ligneous, with calyx limb persistent on septum; seeds several, small, ovoid-triangular, bilaterally compressed, winged at both ends.

Four species: China, Malay Peninsula, Moluccas, New Guinea, Philippines, Thailand; one species in China.

**1. *Pertusadina metcalffii*** (Merrill ex H. L. Li) Y. F. Deng & C. M. Hu, *Blumea* 51: 559. 2006.

海南槽裂木 hai nan cao lie mu

*Adina metcalffii* Merrill ex H. L. Li, *J. Arnold Arbor.* 24: 454. 1943; *A. affinis* F. C. How; *A. hainanensis* F. C. How; *A. polycephala* Benth. var. *glabra* F. C. How; *Pertusadina hainanensis* (F. C. How) Ridsdale.

Shrubs to large trees, perhaps evergreen, to 30 m tall; branches angled to terete, reddish brown becoming gray, puberulent to glabrous, with scattered lenticels. Petiole 3–25 mm, glabrous or puberulent; leaf blade drying thickly papery, elliptic to elliptic-oblong or oblanceolate, 4–12 × 1.5–5 cm, adaxially glabrous and rather shiny, abaxially glabrous to puberulent, base cuneate to obtuse, apex acuminate; lateral veins 6–10 pairs, in abaxial axils with foveolate and/or pilosulous domatia; stipules linear-oblong to subulate, 4–6 × 1–2 mm, glabrous, apex acute or occasionally emarginate to shortly bifid. Inflorescence puberulent to glabrescent; peduncles 1–6.5 cm; flowering heads

solitary on peduncles or occasionally 3 in a cyme, 6–8 mm in diam. across calyces, ca. 15 mm in diam. across corollas; bracteoles linear-clavate to linear-spatulate, 0.5–1 mm, at apex ciliate. Calyx puberulent to pilosulous at least at junction of ovary and limb; ovary portion obconic, 0.5–0.7 mm, surrounded at base by ring of trichomes 0.2–0.5 mm; limb deeply lobed; lobes linear-oblong to spatulate, 1.5–2 mm. Corolla with tube 2–2.5 mm, glabrous inside; lobes deltoid, 0.7–1 mm. Stigmas obovoid, ca. 0.3 mm, exserted for 7–8 mm. Fruiting head 10–12 mm in diam. Capsules 2–4 mm, puberulent to strigose; seeds 1–2 mm. Fl. May–Jun, fr. Sep–Dec.

Dense forests; 100–900 m. Fujian, Guangdong, Guangxi, Hainan, Hunan, Zhejiang [Thailand].

*Pertusadina metcalffii* was illustrated by How (*Sunyatsenia* 6: 239, f. 28; 241, f. 29. 1946, the first as “*Adina affinis*” and the second as “*Adina hainanensis*”). Ridsdale (*Blumea* 24: 354. 1979) treated this species as *P. hainanensis*, but, as noted by Deng and Hu (loc. cit.), the names listed in synonymy by him included an older name that has priority, *A. metcalffii*, confirmed by them as conspecific.

## 70. PHUOPSIS (Grisebach) Benth. & J. D. Hooker, *Gen. Pl.* 2: 151. 1873.

长柱草属 chang zhu cao shu

Chen Tao (陈涛); Friedrich Ehrendorfer

*Asperula* sect. *Phuopsis* Grisebach, *Spic. Fl. Rumel.* 2: 167. 1846.

Herbs, perennial, rhizomatous. Raphides present. Leaves and leaflike stipules in whorls of 6–10, sessile, without domatia, with margins minutely antrorsely aculeolate. Inflorescences terminal, pedunculate, capitate, ± many flowered, enclosed by a whorl of free leaflike bracts, flowers subtended by acuminate bracts. Flowers sessile, bisexual, monomorphic. Calyx limb obsolete. Corolla pink, slender, salverform, inside glabrous; lobes 5, valvate in bud. Stamens 5, inserted in corolla tube, included to partially exserted; filaments short; anthers dorsifixed. Ovary 2-celled, smooth, ovules 1 in each cell, erect, basal, anatropous; stigma clavate, shortly 2-lobed at apex, strongly exserted. Fruit schizocarpous, 2 mericarps ellipsoid to obovoid, dry, rather hard, indehiscent, 1-celled, each with 1 ellipsoid to curved, smooth to striate seed.

One species: SW Asia (Azerbaijan, NW Iran), occasionally cultivated as an ornamental in China.

*Phuopsis* belongs to the core genera of the tribe Rubieae (subtribe Rubiinae). Remote and DNA-supported affinities exist with *Crucianella*, some groups of *Asperula*, and particularly with the widespread annual *Sherardia*. In the present volume *Phuopsis* is briefly discussed in the introduction to the genus *Galium* and keyed out there. *Phuopsis* is a monotypic relict genus restricted to the small Hyrcanian area of NW Iran and Talysh in S Azerbaijan (Ehrendorfer et al., *Fl. Iranica* 176: 1–287. 2005). Its single species has secondary pollen presentation and is butterfly-pollinated.

**1. *Phuopsis stylosa*** (Trinius) Benth. & J. D. Hooker ex B. D. Jackson, *Index Kew.* 2: 505. 1894.

长柱花 chang zhu hua

*Crucianella stylosa* Trinius, *Mém. Acad. Imp. Sci. St. Pétersbourg Hist. Acad.* 6: 485. 1818.

Herbs, 20–60(–70) cm tall; branches quadrangular, glabrous to sparsely hairy, at least at nodes and along angles ± retrorsely aculeolate. Leaves drying papery, narrowly lanceolate, narrowly elliptic, or narrowly oblanceolate, 12–30 × 1.5–6 mm, both surfaces glabrous, base acute to attenuate, margin and

midrib abaxially thickened and antrorsely aculeolate, apex acute to acuminate with acicular tip; secondary veins not visible. Inflorescences hemispherical to subglobose, 1.5–3 cm wide (not including involucreal leaves); bracts leaflike, lanceolate, 8–12 mm, glabrescent, marginally and abaxially spinulose with acute apex. Ovary ellipsoid, ca. 1 mm, glabrous. Corolla glabrous outside; tube 9–12 mm; lobes 5, 1–2 mm, oblong-ovate, apex acute and somewhat thickened. Mericarps oblong-ovate, ca. 1.5 mm. Fl. May–Aug, fr. Aug–Sep.

Cultivated in Shaanxi (Wugong) [native in deciduous forests of SW Asia (Azerbaijan, NW Iran)].

## 71. PORTERANDIA Ridley, *Bull. Misc. Inform. Kew* 1939: 593. 1940.

绢冠茜属 juan guan qian shu

Chen Tao (陈涛); Charlotte M. Taylor

*Randia* sect. *Anisophyllea* J. D. Hooker, *Fl. Brit. India* 3: 113. 1880.

Shrubs or trees, [sometimes dioecious], unarmed. Raphides absent. Leaves opposite, sometimes anisophyllous, sometimes with

domatia; stipules persistent, interpetiolar to shortly united around stem, triangular. Inflorescences pseudoaxillary [or terminal], cymose to thyrsiform, few to several flowered, pedunculate, bracteate. Flowers sessile to pedicellate, bisexual [or unisexual]. Calyx limb well developed, 5-lobed. Corolla white, salverform, outside densely sericeous, inside variously glabrous or pubescent; lobes 5(or 6), convolute in bud. Stamens 5, inserted in upper part of corolla tube, included or partially exerted; filaments very short or absent; anthers dorsifixed. Ovary 2-celled, ovules numerous in each cell on axile placentas; stigma clavate or fusiform, bifid, striate, included or perhaps exerted. Fruit perhaps yellow to brown, baccate, fleshy to woody, subglobose or obovoid, with calyx limb tardily deciduous; seeds numerous, medium-sized, ellipsoid or reniform, flattened, embedded in pulp.

About 22 species: S and SE Asia, Pacific islands; one species (endemic) in China.

Formerly several African species were included in *Porterandia*, but these have separated as *Aoranthe* Somers (see Somers, Bull. Jard. Bot. Natl. Belg. 58: 47–75. 1988). Puff et al. (Rubiaceae of Thailand, 64. 2005) reported that the calyx limb is persistent in fruit in *Porterandia*, but their own figure seems to show it deciduous; on herbarium specimens of various *Porterandia* species the calyx limb appears to fall as the fruit approach mature size. W. C. Chen (in FRPS 71(1): 386. 1999) reported that the corolla lobes are rarely 6, but this number has not been reported by other authors; it is not clear if this number is consistent or is a report of infrequent unusual flowers, which occurs periodically in many species of Rubiaceae. W. C. Chen and Puff et al. described the stamens and stigmas as included, but they are shown as exerted in Chen's figure (loc. cit.: 385, t. 101). W. C. Chen (loc. cit.: 384) also described the ovary as incompletely 4-celled, but no other authors have reported this.

**1. *Porterandia sericantha*** (W. C. Chen) W. C. Chen, Fl. Reipubl. Popularis Sin. 71(1): 384. 1999.

绢冠茜 *juan guan qian*

*Randia sericantha* W. C. Chen, Guihaia 7: 298. 1987.

Shrubs or trees, 1–8 m tall; branches compressed to terete, moderately to densely ferruginous hirtellous. Petiole 3–15 mm, moderately to densely pilosulous or hirtellous to glabrescent; leaf blade drying papery, elliptic or oblanceolate-oblong, 5.5–16 × 2–5 cm, adaxially and sparsely strigillose, abaxially sparsely to densely pilosulous or hirtellous, base acute to obtuse, apex acute to usually shortly acuminate; secondary veins 8–12 pairs, in abaxial axils with pilosulous domatia; stipules ovate to trian-

gular, 5–7 mm, moderately to densely strigillose to hirtellous or glabrous. Inflorescences few to several flowered, cymose, 2–5.5 × 3–5 cm, densely pilosulous to hirtellous, sessile to pedunculate; peduncle to 0.5 cm; bracts triangular, lanceolate, or stipuliform, ca. 3 mm, acute to acuminate; pedicels 5–15 mm. Calyx densely pilosulous and/or strigose; ovary portion obconic, ca. 2 mm; limb 5–6 mm, lobed partially to deeply; lobes ovate-lanceolate, acute. Corolla white, outside densely yellow sericeous; tube ca. 30 × 3.5 mm, inside glabrous except with a villous ring at middle; lobes ovate-elliptic, ca. 12.5 × 6 mm. Stigma ca. 1.5 mm. Berry subglobose, 8–15 mm in diam., pilosulous to strigillose; seeds ca. 4 mm. Fl. May–Jun, fr. Aug–Jan.

• Forests or thickets at streamsides in valleys or on mountain slopes; 300–1500 m. Guangxi, Yunnan.

## 72. PRISMATOMERIS Thwaites, Hooker's J. Bot. Kew Gard. Misc. 8: 268. 1856.

南山花属 *nan shan hua shu*

Chen Tao (陈涛); Charlotte M. Taylor

Shrubs or small trees, unarmed; branches usually longitudinally ridged on each side and surrounded at base by persistent leafless stipules, with bark often yellowed and hardened. Raphides present. Leaves opposite, decussate on ascending branches and distichous on horizontal branches, without domatia; stipules persistent at least on younger nodes, interpetiolar, bilobed, often becoming hardened with age. Inflorescences terminal on principal branches, or terminal on axillary short shoots and apparently axillary, umbelliform to fasciculate and several flowered or reduced to 1 flower, sessile to pedunculate, bracteate with bracts usually reduced. Flowers pedicellate or sessile, bisexual, usually distylous [occasionally fused by their ovaries]. Calyx limb truncate or 4 or 5(or 6)-lobed, with lobes infrequently unequal with 1 larger than others. Corolla white, salverform, inside glabrous; lobes (4 or)5(or 6), valvate in bud. Stamens (4 or)5(or 6), inserted at or above middle of corolla tube, included in long-styled flowers or partially exerted in short-styled flowers; filaments short; anthers dorsifixed. Ovary 2-celled, ovules 1(or 2) in each cell, on axile placentas attached near or above middle of septum; stigma 2-lobed, exerted in long-styled flowers, included in short-styled flowers. Infructescences occasionally displaced to pseudoaxillary by subsequent branch growth. Fruit simple [or infrequently multiple], purple-black to blue-black, drupaceous, fleshy, subglobose or globose, with calyx limb persistent; pyrenes 1 or 2, 1-celled, subglobose when solitary to plano-convex when paired, thin-walled, with membranous preformed germination slits; seeds medium-sized, subglobose to plano-convex, on ventral face with deeply concave hilum; testa membranous; endosperm corneous; embryo small, with hypocotyl; radicle hypogynous.

Fifteen species: Bangladesh, Borneo, Cambodia, China, India (including Andaman Islands), Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Sri Lanka, Thailand, Vietnam; one variable species in China.

This genus was revised in a broad treatment by Johansson (Opera Bot. 94: 1–62. 1987), who reported that the flowers are strongly fragrant. This genus was also treated for China almost simultaneously and apparently independently by Ruan (Acta Phytotax. Sin. 26: 443–449. 1988), whose conclusions differed markedly from those of Johansson.

Two species have been recognized in China, *Prismatomeris tetrandra* and *P. connata*, with two subspecies recognized for *P. connata* (Y. Z. Ruan in FRPS 71(2): 178–179. 1999); *P. tetrandra* subsp. *multiflora* included only plants from Yunnan, while plants of the rest of China were treated

in *P. connata*, with plants from the mainland in subsp. *connata* and plants from Hainan in subsp. *hainanensis*. However, wide and continuous morphological variation was documented by Johansson (loc. cit.) and Puff et al. (Rubiaceae of Thailand, 118. 2005) within *P. tetrandra* in adjacent countries, both across the region and in local populations; and Johansson (in herb.) recognized one species and no infraspecific taxa in China. *Prismatomeris connata* was distinguished originally by its connate rather than separate stigmas; however, this character was later said by Y. Z. Ruan to vary within this species. Its subspecies were distinguished by the degree of lobing of the calyx limbs and the shape and degree of swelling of the stigmas, but as there appears on the specimens studied to be continuous variation in these characters and some plants from the mainland match the characters given for the Hainan subspecies these plants are not separated here.

**1. *Prismatomeris tetrandra*** (Roxburgh) K. Schumann in Engler & Prantl, Nat. Pflanzenfam. 4(4): 138. 1891.

四蕊三角瓣花 si rui san jiao ban hua

*Coffea tetrandra* Roxburgh, Fl. Ind. 2: 193. 1824; *Octotropis terminalis* C. B. Clarke; *Prismatomeris connata* Y. Z. Ruan; *P. connata* subsp. *hainanensis* Y. Z. Ruan; *P. multiflora* Ridley; *P. tetrandra* subsp. *multiflora* (Ridley) Y. Z. Ruan.

Shrubs or small trees, to 8 m tall; branches quadrangular to subterete, glabrous. Petiole 4–15 mm, glabrous; leaf blade drying leathery to stiffly papery and rather shiny, lanceolate, elliptic, elliptic-oblong, ovate, obovate, or oblong-lanceolate, 4–18 × 2–6 cm, glabrous, base cuneate to acute, apex acuminate or acute to obtuse; secondary veins 5–9 pairs; stipules with sheath portion 0.2–1 mm, truncate, persistent or deciduous by fragmentation, bilobed, lobes linear to narrowly triangular, 0.1–0.5 mm, caducous. Peduncles 1–16 and fascicled or umbellate, 5–35 mm, simple or bearing an umbellate group of pedicels, at base with stipuliform bracts; pedicels when present 5–15 mm. Flowers pedunculate or pedicellate. Calyx glabrous or sparsely glandular-puberulent; hypanthium portion hemispherical, 1.5–2 mm; limb 1–2 mm, truncate or 4- or 5-denticulate. Corolla

white or pale purple, salverform, glabrous outside; tube 14–20 mm; lobes 4 or 5, lanceolate, 7–10 mm, abaxially (i.e., dorsally) ridged at least in bud, acute to obtuse. Drupes subglobose, 8–12 mm in diam., glabrous, smooth. Fl. May–Sep, fr. Sep–Dec.

Forests, thickets; 300–2400 m. Fujian, Guangdong, Guangxi, Hainan, S Yunnan [Cambodia, India, Thailand, Vietnam].

Johansson (Opera Bot. 94: 29. 1987) recognized two subspecies, *Prismatomeris tetrandra* subsp. *tetrandra* and *P. tetrandra* subsp. *mala-yana* (Ridley) J. T. Johansson; he reported only subsp. *tetrandra* from China. However, Puff et al. (Rubiaceae of Thailand, 118. 2005) noted that further observation shows that even these taxa cannot be completely separated either morphologically or geographically. Y. Z. Ruan (in FRPS 71(2): 178. 1999) included the Chinese plants in *P. tetrandra* subsp. *multiflora*, which Johansson synonymized with subsp. *tetrandra*. Ruan (loc. cit.) reported that the flowers of *P. connata* are occasionally unisexual; this was not further documented there and has not been reported by others nor confirmed with specimens. Ruan (loc. cit.: 179) also described the calyx lobes as ca. 3 mm, which has not been reported by other authors nor seen on the rather ample materials studied.

This species was newly reported from India by Ayappan and Parthasarathy (J. Econ. Taxon. Bot. 29: 802–804. 2005), and its distribution in Cambodia and Vietnam is here reported based on specimens at P annotated by Johansson after the publication of his article.

### 73. **PSEUDOPYXIS** Miquel, Ann. Mus. Bot. Lugduno-Batavi 3: 189. 1867.

假盖果草属 jia gai guo cao shu

Chen Tao (陈涛); Charlotte M. Taylor

Herbs, perennial, low, unarmed, rhizomatous, sometimes with fetid odor. Raphides present. Leaves opposite or sometimes basalmost pairs reduced to prophylls, without domatia; stipules persistent, interpetiolar and fused to petioles, triangular or 3(or 5)-lobed, often glandular-dentate. Inflorescences terminal and in uppermost leaf axils (or subtended by leaflike bracts), fasciculate and 2- to several flowered or sometimes 1-flowered, pedunculate or sessile, bracteate or bracts reduced. Flowers pedunculate or pedicellate, bisexual, apparently monomorphic. Calyx limb deeply 5-lobed, usually markedly reticulate-veined, with lobes often unequal. Corolla white or purplish red, slenderly tubular-funnelform to salverform, inside glabrous or pubescent in throat; lobes 5, valvate-induplicate in bud. Stamens 5, inserted at base of corolla tube, included to exerted; filaments short to developed; anthers dorsifixed. Ovary 4- or 5-celled, ovules 1 in each cell, anatropous on basal placentas; stigmas 2-, 4- or 5-lobed, exerted. Fruit capsular, obconic to hemispherical, papery, dehiscent through apical lid or operculum within persistent calyx limb, with pedicels becoming reflexed; seeds 3–5, obovoid, longitudinally grooved (or with many longitudinal idioblasts containing raphides).

Three species: China, Japan; one species (endemic) in China.

H. S. Lo (in FRPS 71(2): 153–155. 1999) reported one species from China, *Pseudopyxis heterophylla* Maximowicz, with morphological characters that include some characters of both *P. heterophylla* and *P. depressa* Miquel as treated by the Fl. Japan (3a: 229. 1993). These two species were both reported there to be endemic to Japan: *P. depressa* with a height of 3–8 cm, uniformly distributed stem pubescence, purple corollas 20–25 mm, very short filaments, and 5 stigmas; and *P. heterophylla* with a height to 50 cm, stem pubescence arranged in lines, white corollas 6–7 mm, developed filaments, and 2 stigmas.

Subsequently, Chen (Edinburgh J. Bot. 64: 303–309. 2007) recognized three species in the genus, describing the Chinese plants as a new species, *Pseudopyxis monilirhizoma*, mainly based on root and stem characters (i.e., including number of leaf pairs). He considered this the species that was treated as *P. heterophylla* by H. S. Lo (in FRPS 71(2): 153–155. 1999).

One of us (Taylor) does not fully agree with the species treatment here but has not had adequate access to all the materials and specimens cited by Chen to evaluate the situation completely. The species circumscription and description given here do not seem to include or account for all the specimens of *Pseudopyxis* from China.

**1. *Pseudopyxis monilirhizoma*** Tao Chen, *Edinburgh J. Bot.* 64: 304. 2007.

胀节假盖果草 zhang jie jia gai guo cao

Herbs, to 10 cm tall, with fetid odor; rhizomes sparsely branched, with nodes tuberous and conspicuously enlarged, with internodes usually more than 2 cm; stems quadrate, glabrous except densely hirtellous or pilosulous in 2 interpetiolar rows. Leaves 2 or 3 pairs; petiole 0.3–2 cm, glabrous or densely pilosulous abaxially; blade drying membranous, deltoid-ovate, 0.8–4.5 × 0.6–3.5 cm, sparsely hispidulous on both surfaces, base cuneate to truncate, margins entire or ciliate, apex acute or

obtuse; secondary veins 4 or 5 pairs; stipules ca. 0.5 mm. Inflorescences 2–6-flowered; peduncles 2–4 mm, puberulent. Calyx hispidulous in lines; hypanthium portion obconic, longitudinally ribbed, ca. 1 mm; lobes ovate to ovate-lanceolate, ca. 2 mm. Corolla white or pink, salverform, externally glabrous, internally pilosulous in tube and on lobes; tube ca. 5 mm; lobes lanceolate or narrowly elliptic-oblong, ca. 4 mm, acute to subacute. Capsules obconic, size not noted; seeds ca. 1.2 mm. Fl. Jun–Aug, fr. Aug–Oct.

• Wet sites in rock crevices or on stream banks in forest understories; 1400–1600 m. Zhejiang (Longquan).

## 74. **PSYCHOTRIA** Linnaeus, *Syst. Nat.*, ed. 10, 2: 906, 929, 1364. 1759, nom. cons.

九节属 jiu jie shu

Chen Tao (陈涛); Charlotte M. Taylor

*Cephaelis* Swartz.

Shrubs, small trees, or rarely vines twining and/or climbing by adventitious roots (*Psychotria serpens*), [infrequently dioecious or polygamo-dioecious], unarmed, tissues and/or pubescence often drying dark gray or dark reddish brown. Raphides present. Leaves opposite or rarely in whorls of 3 or 4, often with foveolate and/or pubescent domatia; stipules caducous or infrequently persistent, interpetiolar or sometimes shortly united around stem, entire or 2-lobed, rarely with lobe glandular, inside (i.e., adaxially) at base with well-developed colleters, these usually persistent after stipule falls, usually drying red-brown. Inflorescences terminal often becoming displaced to pseudoaxillary or rarely axillary, cymose, corymbose, paniculiform, glomerulate, or capitate, several to many flowered, sessile to pedunculate, bracteate with bracts sometimes reduced or sometimes enlarged or involucre. Flowers sessile to pedicellate, bisexual, usually distylous [or infrequently unisexual]. Calyx limb (4 or)5(or 6)-lobed. Corolla white, yellow, or flushed with pink, funnelform to tubular, inside glabrous or variously pubescent, lobes (4 or)5(or 6), valvate in bud, sometimes abaxially with thickenings or horns near apex. Stamens (4 or)5(or 6), inserted in corolla tube or throat, usually included or partially exerted in long-styled flowers and exerted in short-styled flowers; filaments short to developed; anthers dorsifixed near base. Ovary 2-celled, ovules 1 in each cell, basal; stigmas 2, linear to subcapitate, usually exerted in long-styled flowers and included in short-styled flowers. Fruit red, orange, or infrequently white (*P. serpens*), purple (*P. manillensis*), or black (*P. cephalophora*, *P. straminea*), drupaceous, fleshy, ellipsoid, ovoid, or subglobose, with calyx limb persistent or infrequently deciduous, with pedicels or stipitate base sometimes elongating; pyrenes 2, 1-celled, each with 1 seed, plano-convex, bony, on dorsal (i.e., abaxial) surface smooth or longitudinally ridged, on ventral surface smooth or longitudinally sulcate; seeds medium-sized, ellipsoid to plano-convex, with testa thin; endosperm fleshy or corneous, sometimes ruminant; embryo small, basal; cotyledon flat.

About 800–1500 species: tropical and subtropical Africa, America, Asia, Madagascar, and Pacific islands; 18 species (five endemic) in China.

The genus *Cephaelis* was separated from *Psychotria* by numerous authors in the 19th and first part of the 20th centuries, based on inflorescence form: *Cephaelis* included species with capitate inflorescences with enlarged, often involucre bracts, vs. branched inflorescences with smaller bracts in *Psychotria*. However, it is now clear that this inflorescence arrangement has arisen far more than once within this group and that “*Cephaelis*” actually included a polyphyletic set of species that are more closely related to various other species of *Psychotria* than to each other. Consequently, recent authors (e.g., Steyermark, *Mem. New York Bot. Gard.* 23: 443–717. 1972; Taylor, *Opera Bot. Belg.* 7: 261–270. 1996) have formally synonymized *Cephaelis* with *Psychotria*.

A recent treatment of *Psychotria* in the Philippines (Sohmer & Davis, *Sida, Bot. Misc.* 27: 1–247. 2007) does not consider any species or names outside its study area but includes some Chinese species that occur in that region. However, these authors have a partially different species concept and morphological interpretation of inflorescence characters from C. M. Taylor, so their work is not completely comparable to the treatment here.

- 1a. Climbing or creeping vines or lianas with adventitious roots, often on tree trunks or rocks; fruit white ..... 14. *P. serpens*  
 1b. Erect, self-supporting subshrubs, shrubs, and small trees growing on ground; fruit orange or red.  
 2a. Leaves strigose to hirsute in similar density on both sides; stipules 15–25 mm, deeply bilobed ..... 12. *P. pilifera*  
 2b. Leaves glabrous adaxially, or pubescent adaxially with distinctly different pubescence than on abaxial surface; stipules 1.5–20 mm, entire to bilobed.  
 3a. Inflorescences capitate, pedunculate, and enclosed by a cupuliform involucre formed of fused bracts ..... 9. *P. laui*  
 3b. Inflorescences capitate to branched, sessile to pedunculate, and variously bracteate, bracts when present free and not forming a single involucre.  
 4a. Calyx limb 1.3–3 mm, shallowly to deeply lobed.

- 5a. Inflorescences thyriform to paniculate, branched to 2 or 3 orders and with well-developed secondary axes ..... 18. *P. yunnanensis*
- 5b. Inflorescences capitate, subcapitate, or congested-cymose, unbranched or branched to 1 or 2 orders but without well-developed secondary axes.
- 6a. Inflorescences capitate to densely congested-cymose, subglobose in outline, sessile or with peduncle to 1 cm ..... 13. *P. prainii*
- 6b. Inflorescences capitate, subcapitate, or shortly congested-cymose, ellipsoid to ovoid or pyramidal in outline, sessile to pedunculate with peduncles to 6 cm.
- 7a. Subshrubs, often rhizomatous; leaves with well-developed, generally straight submarginal vein extending along most or all of length of blade ..... 2. *P. calocarpa*
- 7b. Shrubs or small trees; leaves without submarginal vein or with submarginal vein incomplete or only weakly developed, extending for up to 1/2–2/3 of length of blade.
- 8a. Inflorescences sessile or with peduncle up to 0.6 cm; stipules 3–12 mm; Hainan ... 7. *P. hainanensis*
- 8b. Inflorescences pedunculate, peduncle 0.5–6 cm; stipules 8–20 mm; Yunnan ..... 11. *P. morinoides*
- 4b. Calyx limb 0.5–1.2 mm, truncate to deeply lobed.
- 9a. Inflorescences capitate to subcapitate or congested-cymose, unbranched or branched but without well-developed secondary axes, or with secondary axes but then primary axis not developed.
- 10a. Flowers subsessile to pedicellate in a single head, with all flowers arising from one axis ..... 3. *P. cephalophora*
- 10b. Flowers variously sessile to pedicellate in a subcapitate head or congested cyme, flowers arising from more than one point or axis ..... 8. *P. henryi*
- 9b. Inflorescences thyriform, paniculate, corymbiform, or congested-cymose to laxly cymose, branched, with both primary and secondary axes developed.
- 11a. Stipules 10–15 mm with at least some of them more than 10 mm; leaves with secondary veins 12–18 pairs with 13 or more pairs on at least some leaves ..... 4. *P. densa*
- 11b. Stipules 1.5–12 mm with at least some less than 10 mm; leaves with secondary veins 4–12 pairs with less than 12 pairs on at least some leaves.
- 12a. Inflorescences pyramidal, with primary axis developed and longer than secondary axes ..... 16. *P. symplocifolia*
- 12b. Inflorescences rounded-corymbiform to broadly pyramidal, with primary axis reduced to developed but not longer than secondary axes.
- 13a. Stipules fused around stem into a distinct sheath, mostly persistent with leaves; leaves with secondary veins prominulous adaxially ..... 15. *P. straminea*
- 13b. Stipules interpetiolar, caducous or deciduous, falling before some of leaves; leaves with secondary veins flat or thinly impressed adaxially.
- 14a. Leaves narrowly elliptic, narrowly elliptic-oblong, narrowly lanceolate, narrowly lanceolate-oblong, or oblanceolate, 4–15 × 1–4.5 cm; stipules at least shortly 2-lobed.
- 15a. Leaves abaxially with distinctive thickened epidermis often mottled when dry, secondary veins covered by epidermis or visible but flat to only slightly thickened ..... 6. *P. fluviatilis*
- 15b. Leaves abaxially with epidermis “normal,” thin and not mottled when dry, secondary veins visible, with different epidermal texture from lamina, flat to prominulous.
- 16a. Plants usually drying dull green, grayish brown, yellowish green, or reddish brown; inflorescences congested-cymose ..... 8. *P. henryi*
- 16b. Plants usually drying reddish brown to dark brown; inflorescences laxly cymose, corymbiform ..... 17. *P. tutcheri*
- 14b. Leaves elliptic, broadly elliptic, broadly elliptic-oblong, ovate, lanceolate-oblong, or obovate, 5–23.5 × 2–9 cm; stipules entire to 2-lobed.
- 17a. Bracts subtending flowers rather well developed, lanceolate to ligulate or triangular, 1.5–3 mm; stipules 2-lobed ..... 5. *P. erratica*
- 17b. Bracts subtending flowers developed to reduced, triangular, 0.2–1.2 mm; stipules obtuse, acute, rounded, or shallowly emarginate.
- 18a. Inflorescences sessile or with peduncle to 0.3 cm; leaves with secondary veins not or only weakly forming a submarginal vein ..... 1. *P. asiatica*

- 18b. Inflorescences pedunculate, peduncles 0.1–3.5 cm; leaves with secondary veins free or usually forming a weak to well-developed, looping submarginal vein ..... 10. *P. manillensis*

**1. *Psychotria asiatica*** Linnaeus, Syst. Nat., ed. 10, 2: 929. 1759.

九节 jiu jie

*Antherura rubra* Loureiro; *Psychotria esquirolii* H. Léveillé; *P. reevesii* Wallich; *P. reevesii* var. *pilosa* Pitard; *P. rubra* (Loureiro) Poiré; *P. rubra* var. *pilosa* (Pitard) W. C. Chen; *Uragoga rubra* (Loureiro) Kuntze.

Shrubs or small trees, 0.5–5 m tall; stems puberulent to glabrous. Petiole 0.7–5 cm, glabrous or rarely puberulent; leaf blade reportedly rather shiny in life, drying papery to leathery, dark red, brownish red, yellowish green, or gray-green, elliptic-oblong, lanceolate-oblong, or rarely oblong-ovate, 5–23.5 × 2–9 cm, adaxially glabrous, abaxially glabrous or puberulent, base acute to obtuse, margins flat to narrowly revolute, apex acute to acuminate or obtuse then abruptly narrowed and acuminate; secondary veins 5–8(–11) pairs, free or weakly forming a broadly looping, incomplete submarginal vein, usually with foveolate and sometimes pilosulous domatia; stipules caducous or sometimes persisting on 2 or 3 nodes, triangular to broadly triangular or broadly ligulate, interpetiolar or shortly united around stem, [3–]6–8 mm, glabrous to puberulent, broadly rounded to obtuse or shallowly emarginate. Inflorescences terminal or sometimes pseudoaxillary, cymose to paniculiform, many flowered, glabrous or usually densely puberulent, sessile and apparently tripartite to shortly pedunculate; peduncle to 0.3 mm; branched portion corymbiform-rounded to broadly pyramidal, 2–10 × 3–5 cm, with 1–3 pairs of developed secondary axes; bracts triangular, 0.2–1 mm; pedicels to 2.5 mm. Flowers subsessile to pedicellate in dichotomous cymules of 3–5. Calyx densely puberulent; hypanthium portion turbinate, 0.8–1.2 mm; limb 0.8–1 mm, subtruncate to denticulate. Corolla white, funnelform, glabrous outside; tube 2–3 mm, in throat white villous; lobes triangular, 2–2.5 mm. Drupes red, subglobose to broadly ellipsoid, 5–8 × 4–7 mm, with pedicels to 10 mm; pyrenes shallowly 3–5-ribbed. Fl. and fr. year-round.

Thickets or forests in ravines, on hill slopes, or at village margins; near sea level to 1500 m. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hunan, Taiwan, Yunnan, Zhejiang, also cultivated in Zhejiang [Cambodia, India, Japan, Laos (commonly collected), Malaysia, Thailand, Vietnam (very commonly collected)].

This species has long been called *Psychotria rubra* in China and *P. reevesii* in Vietnam. However, recently Davis et al. (Bot. J. Linn. Soc. 135: 34–52. 2001) matched the Chinese plants to the type specimen of *P. asiatica*, which is thus the correct name for these plants. The objective of their work was limited, however, and they did not address the whole circumscription and range of this species, nor the identity of *P. rubra*. The Chinese specimens treated under this name here closely match the specimens included by them in *P. asiatica*, and the range of this species is here accordingly expanded to include this range. As noted by Davis et al. (loc. cit.), all the flowers seen have the anthers exerted and the stigmas included and positioned near the middle of the corolla tube, thus resembling the short-styled form of distylous species of *Psychotria*.

**2. *Psychotria calocarpa*** Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 41: 315. 1872.

美果九节 mei guo jiu jie

Subshrubs, 0.25–1 m tall, often rhizomatous; stems pilosulous to glabrous. Petiole 0.5–4 cm, glabrous or brown pilosulous; leaf blade drying papery, brownish red, gray, or dark green, elliptic-oblong, elliptic, obovate-oblong, or elliptic-lanceolate, 9.5–17 × 2.5–7 cm, glabrous on both surfaces or densely puberulent to hirtellous abaxially, base cuneate to acute, margins flat, apex acute, acuminate, or rarely obtuse; secondary veins 9–15 pairs, forming a generally straight submarginal vein, without domatia; stipules caducous, ovate to suborbicular, interpetiolar, basal portion 4–10 mm, glabrous or puberulent to hirtellous, 2-lobed, lobes narrowly triangular, 2–6 mm, acuminate to subulate. Inflorescences terminal or pseudoaxillary, congested-cymose, several to many flowered, hirtellous; peduncle 0.8–2 cm; branched portion corymbiform to subglobose, 1–3 × 2–4 cm, branched to 1 or weakly 2 orders; bracts lanceolate to narrowly triangular, 0.8–5 mm; pedicels 1–6 mm. Flowers pedicellate. Calyx glabrous to puberulent; limb ca. 2 mm, deeply lobed; lobes linear to linear-lanceolate, entire to ciliolate. Corolla white; tube ca. 2 mm, white villous inside; lobes elliptic-oblong, obtuse. Drupes red or orange, ellipsoid, 7–8.5 × 4.5–6 mm; pyrenes with 4 or 5 low ridges. Fl. May–Jul, fr. Aug–Feb of following year.

Forests on mountain slopes; 800–1700 m. Xizang, Yunnan [Bangladesh, Bhutan, India, Malaysia, Myanmar, Nepal, Thailand, Vietnam].

This species is used medicinally.

W. C. Chen (in FRPS 71(2): 51. 1999) described the calyx lobes as 4, but they are 5 on all the specimens studied.

**3. *Psychotria cephalophora*** Merrill, Philipp. J. Sci., C, 3: 438. 1909.

兰屿九节木 lan yu jiu jie mu

*Psychotria kotoensis* Hayata.

Shrubs or small trees, height not noted; stems glabrous. Petiole 1.2–6 cm, glabrous; leaf blade drying papery, pale reddish brown, dark brown, or green sometimes tinged with red-purple, elliptic, elliptic-oblong, or elliptic-ovate, 10–16 × 3.5–7 cm, glabrous on both surfaces, base cuneate to acute, margins flat, apex acute or acuminate; secondary veins 6–12 pairs, free or forming a weak submarginal vein, without domatia; stipules caducous, ovate, interpetiolar or shortly fused around stem, 7–10 mm, glabrous, ciliate, 2-lobed for ca. 1/5 of length, lobes ligulate to triangular. Inflorescences terminal, subcapitate to congested-cymose, several flowered, subsessile to sessile, glabrous to densely hirtellous; bracts triangular to ligulate, 1–3 mm; pedicels to 2 mm. Flowers subsessile to pedicellate. Calyx glabrous; hypanthium portion turbinate, ca. 1 mm; limb ca. 1 mm, lobed for 1/3–1/2; lobes deltoid to narrowly triangular. Corolla

in bud white, funnellform, glabrous outside; tube ca. 1.5 mm, villous inside; lobes triangular-oblong, ca. 1.5 mm. Drupes becoming red then black, ellipsoid to obovoid, 8–10 × 6–8 mm, with pedicels to 7 mm; pyrenes smooth or very shallowly 3- or 4-ribbed. Fl. Apr, fr. Aug.

Broad-leaved forests; below 100–400 m. Taiwan (Lan Yu) [Philippines].

The stipules of these plants have been described by previous authors as acute to obtuse, but these are bilobed on all the specimens studied, although this is difficult to see in many cases because the lobes are usually imbricate in bud.

This name is here provisionally applied to these plants. Sohmer and Davis (*Sida*, Bot. Misc. 27: 60–63. 2007) excluded the Taiwanese plants from their circumscription of *Psychotria cephalophora*, without providing another name for them (presumably *P. kotoensis* would be available) or delimiting the differences between the two. They noted that the endosperm of *P. cephalophora* is ruminant although the pyrenes are smooth on the outer surface; the Taiwanese specimens studied do appear to have ruminant endosperm.

**4. *Psychotria densa*** W. C. Chen, *Acta Phytotax. Sin.* 30: 270. 1992.

密脉九节 mi mai jiu jie

Shrubs, 1–3 m tall; stems densely dark hirtellous to tomentulose. Petiole 1.5–7.5 cm, densely hirtellous; leaf blade drying papery or thinly leathery, dark brownish gray or greenish gray, elliptic, elliptic-oblong, or oblong-oblong, 10–26 × 4–12.5 cm, glabrous adaxially, hirtellous abaxially with pubescence denser along principal veins, base cuneate to obtuse, margins flat, apex acute or shortly acuminate; secondary veins 12–18 pairs, forming a weak to distinct submarginal vein, without domatia; stipules caducous, broadly triangular to triangular-ovate, interpetiolar, 10–15 mm, densely hirtellous to tomentulose, acute to acuminate or bilobed for 1/10–1/3, lobes ligulate to deltoid, rounded to acute or acuminate. Inflorescences terminal, congested-cymose to thyrsiform, many flowered, densely hirtellous to tomentulose, pedunculate; peduncle 1–3 cm; branched portion pyramidal to rounded, 3–7 × 2.5–7.5 cm; bracts triangular to ovate, 1–4 mm, often glabrescent. Flowers sessile or subsessile. Calyx glabrous; hypanthium portion obconic, ca. 2 mm; limb 0.5–1.2 mm, lobed for ca. 1/2; lobes triangular. Corolla presumably white, tubular, glabrous outside; tube ca. 4 mm, in throat white villous; lobes triangular-oblong, ca. 2 mm. Drupes red, ellipsoid, 8–10 × 5–6 mm; pyrenes 3- or 4-ribbed. Fl. Apr–May, fr. Jun–Jan of following year.

• Forests on mountains; 1200–1700 m. Yunnan (Hekou, Pingbian).

This name was validly published as cited above; the same article was republished later in the same journal in the same year, with this species treated on pp. 484–486. The later treatment is sometimes cited as the place of publication but is superfluous. The protologue described the stipules as “acuminate” and this was illustrated in the figure, but a paratype (*X. Q. Liu 100347*, MO!) has shortly bilobed stipules.

**5. *Psychotria erratica*** J. D. Hooker, *Fl. Brit. India* 3: 168. 1880.

西藏九节 xi zang jiu jie

Shrubs, 0.4–1 m tall; stems glabrous. Petiole 0.5–5 cm, glabrous to puberulent; leaf blade drying papery to stiffly papery, dark green, greenish brown, or reddish brown, elliptic, broadly elliptic, or obovate, 7–17 × 2–8 cm, glabrous adaxially, glabrous to densely puberulent abaxially, base acute to cuneate, margins flat, apex acute to acuminate; secondary veins 9–12 pairs, not forming a submarginal vein, without domatia; stipules caducous, oblong-lanceolate to broadly ovate, interpetiolar, 5–12 mm, puberulent, strigillose, or hirtellous, 2-lobed for 1/4–1/2, lobes triangular to narrowly triangular sometimes with linear tip 2–9 mm, sometimes erose and glandular. Inflorescences terminal or pseudoaxillary, cymose, sessile to pedunculate, puberulent to densely hirtellous with pubescence sometimes in lines; peduncle to 6.5 cm; branched portion corymbiform, 2.5–4.5 × 4–6 cm, with 1 or 2 pairs of developed secondary axes; bracts ligulate, lanceolate, or narrowly triangular, 0.5–3 mm, sometimes 2-lobed, those subtending flowers 1.5–3 mm; pedicels to 1.5 mm. Flowers subsessile to pedicellate in dichasial cymes of 3–11. Calyx glabrous to puberulent; hypanthium portion obconic, 0.8–1.2 mm; limb 0.8–1.2 mm, lobed for 1/4–1/2; lobes triangular to broadly triangular. Corolla white to pale green, tubular to tubular-funnelform, outside glabrous; tube 3.5–4 mm, densely villous in throat; lobes triangular, ca. 2.5 mm, thickened at apex. Drupes red or yellow, ellipsoid to obovoid, 6–8 × 5–6 mm, with pedicels to 5 mm; pyrenes shallowly 3- or 4-ribbed. Fl. Apr–May, fr. Aug, Oct–Nov.

Subtropical evergreen broad-leaved forests on mountains; 1000–2400 m. Xizang (Médog), Yunnan [Bhutan, India, Nepal].

This species, as represented by Indian specimens and circumscribed here, is quite variable in leaf size and shape, degree of stipule lobing, and inflorescence form (in particular peduncle development).

**6. *Psychotria fluviatilis*** Chun ex W. C. Chen, *Acta Phytotax. Sin.* 30: 268. 1992.

溪边九节 xi bian jiu jie

Shrubs, 0.4–3 m tall; stems glabrous. Petiole 0.5–1.8 cm, glabrous; leaf blade drying papery to thinly leathery, grayish olive-green, yellowish green, or occasionally dark brown (*Zhang Guicai 488*, MO!), sometimes paler below, oblanceolate, narrowly elliptic, or narrowly elliptic-oblong, 5–11 × 1–3.7 cm, glabrous, abaxially with silvery or mottled thickened epidermis, base acute to cuneate, margins flat, apex deltoid, acute, or acuminate; secondary veins 4–8 pairs, not forming a submarginal vein, without domatia; stipules caducous, lanceolate or triangular, interpetiolar, 4–7 × 2.5–5.5 mm, glabrous, 2-lobed for 1/10–1/4, lobes narrowly triangular to linear, sometimes gland-tipped. Inflorescences terminal or often to pseudoaxillary, cymose-paniculiform, few to several flowered, glabrous, sessile to pedunculate; peduncle to 0.7 cm; branched portion corymbiform or broadly pyramidal, 1–3 × 1–1.5 cm, with 1 or 2 pairs of developed secondary axes; bracts triangular to linear-lanceolate, 0.5–1.5 mm; pedicels to 2 mm. Flowers subsessile and pedicellate in small dichotomous cymes. Calyx glabrous; hypanthium portion obconic, 1–1.5 mm; limb 0.5–1 mm, lobed shallowly or for up to 1/5; lobes broadly triangular. Corolla white, tubular, glabrous outside; tube 3–3.5 mm, in throat white villous; lobes triangular-oblong, 1–1.7 mm. Drupes red, oblong-

ellipsoid or subglobose, 6–7 × 3–6 mm, with pedicels to 10 mm; pyrenes shallowly 3- or 4-ribbed. Fl. Apr–Sep, fr. Aug–Dec.

• Forests along valley streams; 500–1000 m. Guangdong, Guangxi.

This name was validly published as cited above; the same article was republished later in the same journal in the same year, with this species treated on pp. 482–483. The later treatment is sometimes cited as the place of publication but is superfluous.

**7. *Psychotria hainanensis*** H. L. Li, J. Arnold Arbor. 25: 213. 1944.

海南九节 hai nan jiu jie

Shrubs, 0.5–3 m tall; stems glabrous. Petiole 0.4–3.5 cm, glabrous; leaf blade drying papery, grayish brown, grayish green, abaxially paler to silvery, elliptic, oblong-elliptic, lanceolate, or lanceolate-oblong, 4.5–16 × 2–6 cm, glabrous on both surfaces or puberulent abaxially, base acute to cuneate, margins flat, apex acute to acuminate; secondary veins 6–14 pairs, forming a rather straight submarginal vein, without domatia; stipules caducous, subtriangular to ovate, interpetiolar, 3–12 mm, glabrous to puberulent, 2-lobed for 1/3–1/2, lobes linear-lanceolate to subulate. Inflorescences terminal, congested-cymose to subcapitate, few flowered, puberulent to glabrous, sessile to pedunculate; peduncle to 0.6 cm; branched portion subglobose, ca. 2 × 2 cm, without developed axes; bracts linear-lanceolate, 2–7 mm; pedicels 0.5–4 mm. Flowers subsessile to shortly pedicellate. Calyx glabrous; hypanthium portion turbinate, ca. 1 mm; limb 2–3 mm, deeply lobed; lobes linear-lanceolate to narrowly ligulate. Corolla white, glabrous outside; tube ca. 4 mm, white villous in throat; lobes oblong-triangular, 1.5–2 mm, apex incurved. Drupes red, ovoid or elliptic, 7–11 × 4.5–7 mm, with pedicels to 8 mm; pyrenes 3- or 5-ribbed. Fl. Apr–May, fr. Jun–Feb of following year.

• Forests along valley streams; 600–1200 m. Hainan.

In the protologue the stipules were incorrectly described as “*apice longe acuminatis*.” In fact, it is the individual lobes that are long acuminate, while the stipules are deeply bilobed.

**8. *Psychotria henryi*** H. Léveillé, Repert. Spec. Nov. Regni Veg. 13: 179. 1914.

滇南九节 dian nan jiu jie

Shrubs, 0.75–2 m tall; stems puberulent. Petiole 0.4–2 cm, puberulent; leaf blade drying papery, reddish brown, grayish brown, yellowish green, or greenish brown, often paler abaxially, narrowly elliptic or narrowly oblong-lanceolate, 4–14 × 1–4.5 cm, glabrous adaxially, puberulent to glabrous abaxially, base acute to cuneate, margins flat, apex acute to acuminate; secondary veins 6–10 pairs, free or forming a weak looping submarginal vein, without domatia; stipules caducous, ovate to triangular, interpetiolar, 1.5–4 mm, puberulent, 2-lobed for 1/5–1/2, lobes linear-lanceolate to subulate. Inflorescences terminal or pseudoaxillary, subcapitate to congested-cymose, few to several flowered, puberulent to glabrous, sessile to shortly pedunculate; peduncle to 0.5 cm; branched portion subglobose to corymbiform, 0.5–1.5 × 0.6–1.5 cm; bracts triangular, 1–1.5

mm; pedicels to 1 mm. Flowers subsessile to pedicellate. Calyx puberulent; hypanthium portion turbinate, ca. 1 mm; limb 0.8–1.2 mm, shallowly to deeply lobed; lobes triangular to narrowly triangular. Corolla white, funnellform, glabrous outside; tube 1.5–2 mm, densely villous in throat; lobes triangular, 1.2–1.5 mm. Infructescences sometimes expanding, to 2 × 3.5 cm; pedicels to 2 mm. Drupes red, ovoid or globose, 4–7 × 3–5 mm; pyrenes shallowly 3- or 4-ribbed. Fl. May–Jun, fr. Aug–Feb of following year.

Forests; 1100–1500 m. Yunnan [Vietnam].

**9. *Psychotria laui*** Merrill & F. P. Metcalf, Lingnan Sci. J. 16: 403. 1937.

头九节 tou jiu jie

*Cephaelis laui* (Merrill & F. P. Metcalf) F. C. How & W. C. Ko.

Shrubs, 1–2 m tall; stems glabrous. Petiole 0.3–0.6 cm, glabrous; leaf blade drying papery, reddish brown, elliptic, elliptic-oblong, or lanceolate, 5–11 × 1.5–3.5 cm, glabrous on both surfaces, base acute to cuneate, margins flat or weakly crisped, apex acute to shortly acuminate; secondary veins 6–8 pairs, not forming a submarginal vein, without domatia; stipules caducous, triangular, interpetiolar or shortly united around stem, 2–5 mm, glabrous, acute. Inflorescences terminal, capitate, glabrous to puberulent, pedunculate; peduncle 1–3.5 cm; heads 1 or rarely 2, hemispherical, 1–2 cm in diam.; outermost bracts connate into a cupuliform involucre 5–6 mm, marginally irregular. Flowers sessile. Calyx with hypanthium portion turbinate, ca. 2 mm, glabrous; limb ca. 2 mm, deeply 5-lobed; lobes narrowly triangular, densely hirsute, ciliate. Corolla white, funnellform, glabrous outside; tube 2–3 mm, densely villous in throat inside; lobes subelliptic to triangular, 1–1.2 mm, apex rostrate. Drupes ellipsoid, oblong-ellipsoid, or narrowly ovoid, 6–8 mm, color not noted; pyrenes longitudinally 4- or 5-ribbed. Fl. Jul.

Mountain forests. Hainan (Changjiang, Dongfang) [Vietnam (*Poilane 21252 P!*)].

The one developed flower seen resembles the long-styled form of distylous *Psychotria* species (*Lau 27455*, MO!). Several Vietnam specimens at P clearly belong to *P. laui*, and this species is here reported from that country as well.

**10. *Psychotria manillensis*** Bartling ex Candolle, Prodr. 4: 522. 1830.

琉球九节木 liu qiu jiu jie mu

Shrubs to 2(–6) m tall; stems glabrous. Petiole 0.5–3.6 cm, glabrous; leaf blade drying thinly leathery, reddish brown to reddish gray, elliptic-oblong, oblong-lanceolate, or obovate-elliptic, 9–18.7[–20.5] × 3–8 cm, glabrous on both surfaces, base acute to cuneate, margins flat to thinly revolute, apex acute or shortly acuminate; secondary veins [6 or]7–12 pairs, free or usually forming a looping submarginal vein, sometimes with foveolate domatia; stipules caducous, triangular to ovate, interpetiolar, 3–6[–10] mm, glabrous, acute to obtuse. Inflorescences terminal or pseudoaxillary, cymose, glabrous [to puberulent], pedunculate; peduncle [0.1–]0.5–3.5 cm; branched portion cor-

ymbiform to broadly pyramidal, 2.5–6 × 3–7 cm; bracts triangular to broadly triangular, 0.3–1.5[–5.8] mm, those subtending flowers 0.3–1.2 mm; pedicels to 2 mm. Flowers sessile to pedicellate. Calyx glabrous; hypanthium portion obconic, 0.8–1 mm; limb 0.5–0.8 mm, lobed for ca. 1/2; lobes broadly triangular. Corolla white, tubular-funnelform, glabrous outside; tube ca. 2[–4] mm, densely villous in throat; lobes triangular, ca. 2 mm. Drupes red or purple, ellipsoid or ovoid-ellipsoid, 8–12[–15] × 5–6 mm; pyrenes 3- or 4-ribbed. Fl. Jun–Aug, fr. Aug.

Broad-leaved forests; near sea level [to 900 m in the Philippines]. Taiwan (Lan Yu) [Japan (Ryukyu Islands), Philippines].

Measurements included here in brackets were reported by Sohmer and Davis (*Sida*, Bot. Misc. 27: 138–142. 2007) for Philippine plants of this species.

**11. *Psychotria morindoides*** Hutchinson in Sargent, Pl. Wilson. 3: 414. 1916.

聚果九节 ju guo jiu jie

Shrubs, 0.5–3 m tall; stems densely hirtellous to tomentulose-pilosulous or glabrescent. Petiole 1.2–6 cm, densely hirtellous to glabrescent; leaf blade drying papery, dark reddish brown, gray, grayish brown, or greenish gray, oblanceolate, obovate, elliptic-obovate, or elliptic-oblong, 8–30 × 3–11.5 cm, glabrous adaxially, puberulent to densely hirtellous abaxially, base acute to obtuse and sometimes oblique, margins flat, apex acute to acuminate and sometimes curved; secondary veins 8–15 pairs, free or forming only a weak looping submarginal vein, without domatia; stipules caducous, oblong-ovate, interpetiolar, 8–20 mm, puberulent to densely hirtellous, ciliate, 2-lobed for 1/4–1/2, lobes narrowly triangular to linear. Inflorescences terminal sometimes becoming pseudoaxillary, capitate to subcapitate, densely hirtellous, many flowered, subsessile to pedunculate; peduncle to 6 cm; head or branched portion ovoid, ellipsoid, or pyramidal in outline, 2–6.5 × 1.5–4 cm; bracts linear, ca. 5 mm. Flowers sessile. Calyx glabrous; hypanthium portion obconic, ca. 1.25 mm; limb 2.5–3 mm, deeply lobed; lobes linear-lanceolate, entire to sparsely ciliate. Corolla white, funnelform to tubular-funnelform, outside glabrous; tube ca. 4 mm, densely villous in throat; lobes lanceolate, 1.2–1.5 mm, apex thickened. Drupes red, ellipsoid, 6–8 × 3–5 mm; pyrenes 3- or 5-ribbed. Fl. Apr–Nov, fr. Jul–Dec.

Forests along valley streams; 1000–2300 m. Yunnan [Laos, Thailand (*Rock 1773*, A!)].

**12. *Psychotria pilifera*** Hutchinson in Sargent, Pl. Wilson. 3: 415. 1916.

毛九节 mao jiu jie

Shrubs, 0.75–1.75 m tall; stems densely villous to villosulous. Petiole 1–5 cm, densely villous; leaf blade drying papery or membranous, dark reddish brown, elliptic, elliptic-obovate, or elliptic-oblong, 8–23 × 3–11 cm, moderately to densely and similarly strigose to hirsute on both surfaces, base acute or obtuse to rounded, margins flat and ciliate, apex acute to shortly acuminate with tip to 1 cm and sometimes curved; secondary veins 5–15 pairs, not forming a submarginal vein, apparently without domatia; stipules caducous to tardily deciduous, ovate-

triangular, interpetiolar, 15–25 mm, densely hirsute to villosulous, 2-lobed for ca. 1/2, lobes narrowly triangular, acuminate to caudate. Inflorescences terminal becoming pseudoaxillary, congested-cymose to subcapitate, densely hirsute or villous, pedunculate; peduncle 3–6.5 cm; branched portion pyramidal to subglobose, 2–3.5 × 2–5 cm; bracts linear-lanceolate, 4–10 mm, ciliate, acuminate. Flowers subsessile. Calyx glabrescent to sparsely villosulous; hypanthium portion obconic, ca. 1 mm; limb 2.5–3.5 mm, lobed for ca. 2/3; lobes narrowly triangular to linear-lanceolate. Corolla in bud funnelform, outside villosulous, to 4 mm. Drupes red, oblong-ellipsoid, 8–10 × 4–5 mm, sparsely villosulous to glabrescent; pyrenes 3- or 4-ribbed. Fl. Jul, fr. Aug–Dec.

• Forests in ravines; 1300–1700 m. Yunnan.

The protologue described the inflorescences as sometimes axillary, but this appears to be a description of the position separated here as pseudoaxillary. W. C. Chen (in FRPS 71(2): 59. 1999) described the petioles as becoming glabrescent with age and the secondary leaf veins as impressed above, but these conditions have not been seen on any of the specimens studied.

**13. *Psychotria prainii*** H. Léveillé, Repert. Spec. Nov. Regni Veg. 9: 324. 1911.

驳骨九节 bo gu jiu jie

*Cephalis siamica* Craib; *Psychotria siamica* (Craib) Hutchinson.

Shrubs, 0.5–2 m tall; stems densely hirtellous. Leaves opposite but sometimes crowded at stem apices; petiole 0.2–2.2 cm, densely hirtellous; blade drying papery or thinly leathery, dark reddish brown, grayish green, or brownish green, elliptic, elliptic-oblong, lanceolate-oblong, obovate-oblong, or ovate, 3–15 × 1.3–6.5 cm, glabrous adaxially, densely hirtellous to hirsute throughout abaxially, base acute to obtuse, margins flat, apex shortly obtuse and sometimes then shortly acuminate; secondary veins 6–11 pairs, free or forming a weak, looping, incomplete submarginal vein, without domatia; stipules caducous, ovate, interpetiolar, 5–15 mm, densely hirtellous, 2-lobed for 1/3–1/2, lobes subulate. Inflorescences terminal or pseudoaxillary, capitate to densely congested-cymose, several flowered, hirtellous, sessile to pedunculate; peduncle to 1 cm; head subglobose, 1–1.5 × 1–1.5 cm; bracts narrowly triangular, 3–7 mm. Flowers sessile or subsessile. Calyx hirtellous; hypanthium portion obconic, ca. 1 mm; limb 1.5–3.5 mm, deeply lobed; lobes narrowly lanceolate, spatulate, or narrowly elliptic, ciliate. Corolla white, funnelform, outside glabrous except pilosulous on tips of lobes; tube ca. 3 mm, densely villous in throat; lobes triangular-ovate, ca. 1.5 mm. Drupes red, ellipsoid or obovoid, 5–8 × 4–5 mm; pyrenes shallowly 4- or 5-ridged. Fl. May–Aug, fr. Jul–Nov.

Rocky thickets, forests in ravines, mountain slopes; 1000–1700 m. Guangdong (Yangshan), W Guangxi, SW Guizhou, Yunnan [Laos, Thailand, Vietnam].

This species is used medicinally.

The illustration of the corollas of this species in FRPS (71(2): 56, t. 14, f. 5–9. 1999) does not agree with the specimens seen; in particular, the tube illustrated is too short in relation to the lobes. No differences

are evident between specimens of *Psychotria siamica* and of *P. prainii*, so the former are here synonymized.

**14. *Psychotria serpens*** Linnaeus, Mant. Pl. 2: 204. 1771.

蔓九节 man jiu jie

*Psychotria scandens* Hooker & Arnott.

Climbing or creeping vines or lianas, to 6 m or more, rather fleshy, juvenile stems appressed to substrate with adventitious roots, reproductive stems spreading at apex; stems glabrous. Petiole 1–10 mm, glabrous; leaf blade drying papery to leathery, pale green, dark reddish green, reddish brown, or dark brown, often paler below, ovate or obovate on juvenile stems and elliptic, elliptic-oblong, lanceolate, oblanceolate, or obovate-oblong on reproductive stems, 0.7–9 × 0.5–3.8 cm, glabrous, base acute to obtuse, margins plane or sometimes thinly revolute, apex acute, obtuse, or sharply acuminate; secondary veins not visible or 3–10 pairs, not forming a submarginal vein, without domatia; stipules caducous, triangular to ovate, interpetiolar or shortly united around stem, 2–3 mm, glabrous, acute to rounded. Inflorescences terminal, cymose, glabrous to puberulent, few to many flowered, branched for 3–5 orders, pedunculate; peduncle 0.5–3 cm; branched portion corymbiform, 1–5 × 1–5.5(–10) cm; bracts subtending secondary axes 1–2 mm and triangular or often leaflike and 3–6 mm, those subtending pedicels triangular, 0.2–1.5 mm; pedicels 0.5–1.5 mm. Flowers pedicellate. Calyx glabrous to puberulent; hypanthium portion obconic, 0.8–1 mm; limb flared, 0.5–1 mm, partially lobed; lobes triangular, ca. 0.5 mm. Corolla white, funnellform, outside glabrous to usually puberulent; tube 1.5–3 mm, in throat densely villous; lobes ligulate-oblong, 1.5–2.5 mm. Drupes white, subglobose or ellipsoid, 4–7 × 2.5–6 mm, with pedicels to 5 mm; pyrenes shallowly 4- or 5-ribbed. Fl. Apr–Jun, fr. year-round.

Thickets or forests in ravines, mountains, hills, flat lands; below 100–1400 m. Fujian, Guangdong, Guangxi, Hainan, Taiwan, Zhejiang [Cambodia, Japan, N Korea, Laos, Thailand, Vietnam].

This species is used medicinally.

W. C. Chen (in FRPS 71(2): 60. 1999) described the stems, petioles (but not the leaf blades), inflorescence axes, and calyces as spreading pubescent, but this has not been seen on any of the specimens studied nor reported by other authors.

This species is commonly collected and morphologically quite variable, including in drying color, leaf size and shape, inflorescence size, and fruit size. The climbing habit and white fruit of this species are unusual in the genus but similar to some other species of Asian *Psychotria* (Sohmer & Davis, Sida, Bot. Misc. 27: 1–247. 2007). The name *P. ixoroides* Bartling ex Candolle has been considered a synonym of *P. serpens* by some authors, notably Merrill, but Sohmer and Davis (loc. cit.: 41–45) considered *P. ixoroides* an accepted species in the Philippines. However, they did not make any comparison there with *P. serpens*. *Psychotria serpens* is also similar to *P. sarmentosa* Blume, which was considered a distinct species by Sohmer (in Dassanayake, Revis. Handb. Fl. Ceylon 6: 349–352. 1987) again without any comparison to *P. serpens*.

**15. *Psychotria straminea*** Hutchinson in Sargent, Pl. Wilson. 3: 416. 1916.

黄脉九节 huang mai jiu jie

Shrubs, 0.5–3 m tall; stems glabrous. Petiole 0.5–3.5 cm, glabrous; leaf blade drying papery to membranous, yellowish green, often pale below, elliptic, elliptic-oblong, oblanceolate, or obovate, 5.5–29 × 0.8–10.5 cm, glabrous on both surfaces, base cuneate to obtuse, margins flat, apex acuminate or acute; secondary veins 5–10 pairs, thinly prominulous adaxially, free or forming an incomplete looping submarginal vein, without domatia; stipules persistent on apical nodes, triangular to ovate or elliptic, shortly fused around stem, 2.5–6.7 mm (including lobes), glabrous, 2-lobed, lobes linear, 0.5–1.2 mm, often tipped with a caducous gland. Inflorescences terminal, few flowered, cymose, glabrous, pedunculate; peduncle 1–2.5 cm; branched portion corymbiform, 1–5 × 1.5–4 cm, branched to 1–3 orders; bracts triangular, 0.2–1 mm; pedicels 1.5–4 mm. Flowers pedicellate in dichotomous cymules of 3–7. Calyx glabrous; hypanthium portion obconic, ca. 1 mm; limb ca. 1 mm, lobed shallowly or to 1/2; lobes triangular. Corolla white or pale green, tubular-funnelform, glabrous outside; tube 1.5–2 mm, villous in throat; lobes ovate-triangular, 1.5–2.5 mm. Drupes red or perhaps ultimately black, subglobose or ellipsoid, 7–13 × 4–9 mm, with pedicels or stipes to 10 mm; pyrenes smooth or shallowly 3- or 4-ribbed. Fl. Jan–Jul, fr. Jun–Jan of following year.

Forests in ravines, hill slopes; 100–2700 m. Guangdong, Guangxi, Hainan, Yunnan [Vietnam].

W. C. Chen (in FRPS 71(2): 52. 1999) described the fruit as black at maturity, and the dried fruit seen have this color; but it remains to be confirmed in living fruit by field observations. Some other *Psychotria* species have fruit that are red at maturity but dry black, while some species have fruit that turn red then ultimately black when ripe.

**16. *Psychotria symplocifolia*** Kurz, Forest Fl. Burma 2: 11. 1877.

山矾叶九节 shan fan ye jiu jie

Shrubs or small trees, 1–5 m tall; stems glabrous. Petiole 0.5–3.5 cm, glabrous; leaf blade drying papery to leathery, dark reddish green, brownish green, or clear green, oblong-obovate, elliptic-obovate, or elliptic-lanceolate, 6–12.7 × 2–6 cm, glabrous on both surfaces, base cuneate to acute, margins flat to thinly revolute, apex shortly and abruptly acuminate; secondary veins 6–12 pairs, free or forming a weak, incomplete, looping submarginal vein, sometimes with foveolate domatia; stipules caducous, ovate, interpetiolar or shortly fused around stem, 6–12 mm, glabrous outside (abaxially), inside (adaxially) densely villous, acuminate, entire or 2-denticulate. Inflorescence terminal, cymose-paniculiform, puberulent to hirtellous with pubescence often in lines, often glabrescent with age, pedunculate; peduncle 1–2.5 cm; branched portion pyramidal, 2.5–6 × 1.5–2.5 cm, with 2 or 3 pairs of developed secondary axes; bracts triangular, 0.1–1 mm. Flowers sessile and subsessile in glomerulate groups. Calyx glabrous; hypanthium portion turbinate, ca. 1 mm; limb ca. 0.5 mm, truncate to shallowly lobed; lobes triangular. Corolla presumably white, salverform to funnellform, glabrous outside; tube ca. 2 mm, in throat white villous; lobes ovate-triangular, 1.5–2.2 mm. Drupes red, ellipsoid, 6–9 × 4–6 mm; pyrenes with 1 longitudinal ridge. Fl. Feb–Apr, fr. Jun.

Forests on mountains; 1200–2300 m. Yunnan [India, Myanmar, N Thailand].

**17. *Psychotria tutcheri*** Dunn, J. Bot. 48: 324. 1910.假九节 *jia jiu jie*

Shrubs, 0.5–4 m tall; stems puberulent to glabrous. Petiole 0.5–2 cm, puberulent to glabrous; leaf blade drying papery to thinly leathery, pale or usually reddish brown to dark brown, narrowly elliptic, narrowly lanceolate-oblong, narrowly lanceolate, or narrowly elliptic-oblong, 5.5–15 × 1.5–4 cm, glabrous adaxially, glabrous to puberulent abaxially, base cuneate to acute, margins flat, apex acuminate or caudate-acuminate; secondary veins 4–8 pairs, free or forming a weak, looping, submarginal vein, without or rarely with pilosulous domatia; stipules caducous, ovate-triangular, triangular, or lanceolate, interpetiolar, 2–8 mm, glabrous to puberulent, 2-lobed for 1/4–1/2, lobes narrowly triangular to linear. Inflorescences terminal and sometimes pseudoaxillary or rarely in uppermost leaf axils (*He Guosheng 6040*, MO!), cymose, densely puberulent, sessile to pedunculate; peduncle to 0.6 cm; branched portion corymbiform, 1.5–6 × 1–4 cm, with 1 or 2 pairs of developed secondary axes; bracts lanceolate to triangular, 0.3–2 mm; pedicels to 0.5 mm. Flowers sessile to subsessile in congested small cymules. Calyx puberulent to glabrescent; hypanthium portion obconic to turbinate, 0.8–1 mm; limb 0.5–0.8 mm, lobed shallowly or up to 1/2; lobes broadly triangular. Corolla white or greenish white, tubular, glabrous outside; tube 2–3 mm, in throat white villous; lobes oblong-lanceolate, 1.5–2 mm. Drupes subglobose, 5–7 × 4–6 mm, color unknown; pyrenes shallowly 3- or 4-ribbed to subsmooth. Fl. Apr–Jul, fr. Jun–Dec.

Thickets or forests in ravines or on hill slopes; 200–1000 m. Fujian, Guangdong, Guangxi, Hainan, Yunnan [Vietnam].

W. C. Chen (in FRPS 71(2): 54. 1999) described leaf sizes and secondary vein numbers that are unusually large, to 22 × 6 cm and 13

pairs, respectively; these measurements have not been seen on any specimens studied nor reported by any other authors.

**18. *Psychotria yunnanensis*** Hutchinson in Sargent, Pl. Wilson. 3: 414. 1916.云南九节 *yun nan jiu jie**Psychotria kwangsiensis* H. L. Li.

Shrubs, 1–4 m tall; stems glabrous. Petiole 1–5.5 cm, glabrous; leaf blade drying papery to membranous, dark brown or greenish brown, sometimes paler below, obovate-oblong, elliptic, ovate-oblong, or oblanceolate, 9–30.5 × 3–11 cm, glabrous on both surfaces or puberulent to hirtellous along principal veins abaxially, base acute to obtuse, margins flat, apex acuminate or acute; secondary veins 8–16 pairs, not forming a submarginal vein, without domatia; stipules caducous, ovate, interpetiolar, 6–15 mm, glabrous or hirtellous in basal portion, 2-lobed for 1/4–1/3, lobes narrowly triangular, acuminate. Inflorescences terminal or pseudoaxillary, thyriform to paniculate, many flowered, puberulent or hirtellous in lines often becoming glabrescent; peduncle 1–6 cm; branched portion pyramidal to broadly pyramidal, 3–10 × 2.5–6.5 cm, with 1 or 2 pairs of well-developed secondary axes, with 3–11 glomerules or cymules; bracts triangular to lanceolate, 1–10 mm, acuminate; pedicels to 3 mm. Flowers subsessile to pedicellate in groups of 5–15. Calyx glabrous; hypanthium portion obconic, ca. 1 mm; limb campanulate, 1.3–2.5 mm, lobed shallowly to deeply; lobes deltoid to narrowly triangular or narrowly lanceolate. Corolla white, salverform, outside glabrous; tube ca. 5 mm, in throat villous; lobes elliptic-oblong, ca. 3 mm. Drupes ellipsoid or subglobose, 6–12 × 4–7 mm, color not noted; pyrenes 4- or 5-ridged. Fl. Apr–Dec.

• Forests in ravines, hill slopes; 800–2300 m. Guangxi (Napo), Xizang (Médog), Yunnan.

**75. PSYDRAX Gaertner, Fruct. Sem. Pl. 1: 125. 1788.**假鱼骨木属 *jia yu gu mu shu*

Chen Tao (陈涛); Charlotte M. Taylor, Henrik Lantz

Shrubs or small trees [or sometimes scandent], unarmed. Raphides absent. Leaves opposite [or sometimes ternate], sometimes with domatia; stipules persistent, interpetiolar or shortly fused to petioles or united around stem, generally triangular to ovate. Inflorescences axillary, cymose and several flowered [or rarely 1-flowered], sessile to pedunculate, bracteate or bracts reduced. Flowers subsessile to pedicellate, bisexual, monomorphic. Calyx limb truncate or 4- or 5-dentate. Corolla white to yellow, tubular to funnelliform, inside variously pubescent; lobes 4 or 5, valvate in bud, markedly reflexed at anthesis. Stamens 4 or 5, inserted in corolla throat, partially to fully exerted; filaments developed, reflexed at anthesis; anthers dorsifixed near base. Ovary 2-celled, ovules 1 in each cell, pendulous from apical placentas; stigma exerted, ovoid to cylindrical, bifid, with style attachment recessed. Fruit generally yellow, drupaceous, fleshy, subglobose to ellipsoid or sometimes dicocous, with calyx limb persistent; pyrenes 2, 1-celled with 1 seed, bony or cartilaginous; seeds medium-sized, ellipsoid, cylindrical, or plano-convex; testa membranous; endosperm fleshy; radicle ascending.

About 100 species: tropical Africa and Asia; one species in China.

The species now treated in *Psychdrax* were long included in *Canthium*, but they were separated out and *Psychdrax* was revived as a genus by Bridson (Kew Bull. 40: 687–725. 1985), subsequently supported by Lantz and Bremer (Bot. J. Linn. Soc. 146: 272–276. 2004). The type species was published as "*Psychdrax dicoccos*," using for the epithet a Greek term that is presumably analogous to "dicoccus" or "dicocum" (cf. Stearn, Botanical Latin. 1983, Group II nouns and Group A adjectives, respectively). Bridson was the first author to accept *Psychdrax* in almost two centuries, and she clearly and explicitly gave feminine endings to all its species including the type, *P. dicocca*. Thus ICBN Art. 62.1 seems to apply here: the assignment of gender to a genus is based on predominance of usage, not the original publication, and *Psychdrax* is here treated as feminine and the epithet of our species as adjectival following Bridson. Bridson also suggested that *P. dicocca* is restricted to Sri Lanka and S India and the Chinese and Malasian plants that have long gone under that name are not conspecific; however, no differences are evident on the specimens studied, and further resolution of this is outside the scope of the current work.

**1. *Psydrax dicocca*** Gaertner, *Fruct. Sem. Pl.* 1: 125. 1788 ["*dicoccos*"].

假鱼骨木 *jia yu gu mu*

Shrubs to trees, to 15 m tall; branches compressed or quadrangular becoming terete, glabrous. Petiole 6–15 mm, glabrous; leaf blade drying leathery, shiny on both surfaces, dark green adaxially, and pale brown abaxially, ovate, elliptic, obovate, ovate-elliptic, or ovate-lanceolate, 4–10 × 1.5–4 cm, glabrous on both surfaces, base cuneate to obtuse, margins often crisped, apex shortly to long acuminate, acute, or obtuse; secondary veins 3–5 pairs, in abaxial axils sometimes with small foveolate domatia; stipules 3–5 mm, glabrous, acute to shortly aristate. Inflorescences 2–3.5 cm, cymose, umbelliform, or fasciculate, puberulent; peduncle 3–8 mm; bracts reduced; pedicels 3–8 mm. Calyx glabrous; ovary portion obconic to cupuliform, 1–1.2 mm; limb ca. 0.5 mm, truncate or usually shallowly 5-dentate. Corolla greenish white or pale yellow, funnelliform, outside glabrous; tube ca. 3 mm, tomentose in throat; lobes 5, triangular to ligulate, 2.5–3 mm, acute. Stigma ca. 1 mm. Drupes obovoid to ellipsoid or subglobose, often weakly dicocous and/or somewhat flattened, 8–10 × 6–8 mm, glabrous; pyrenes rugose. Fl. Jan–Aug, fr. Jun–Nov.

Sparse forests or thickets at low to middle elevations, broad-leaved forests; 100–600 m. Guangdong, Guangxi, Hainan, Xizang, Yunnan [India, Indochina, Indonesia, Malaysia, Philippines, Sri Lanka, Thailand; Australia].

The filaments are bent at ca. 180° at anthesis, so the anthers are fully reflexed and held parallel to the corolla tube but upside-down. W. C. Ko (in *FRPS* 71(2): 11. 1999, as *Canthium dicocum*) described the corolla lobes as slightly shorter than the tube, but on several specimens studied these structures appear to be essentially equal in length. The fruit color at maturity seems not to have been noted by any authors or collectors.

The varieties recognized by W. C. Ko (loc. cit.: 11–13) are treated here for reference. In addition to the characters given in the key below,

W. C. Ko distinguished *Canthium dicocum* var. *dicocum* by its stigmas entire to bilobed and *C. dicocum* var. *obovatifolium* by its stigmas entire or often bifid or emarginate; however, the stigmas of all of these plants are held together and appear entire when young, then spread and become shallowly to markedly bifid at anthesis. Thus, the stigma distinctions may be developmental rather than population-level differences.

- 1a. Leaf blade ovate, elliptic, or ovate-lanceolate; flowers in axillary cymes; fruit obovoid to ellipsoid ..... 1a. var. *dicocca*
- 1b. Leaf blade obovate or ovate-elliptic; flowers 4–6 in axillary fascicles; fruit subglobose or ellipsoid ..... 1b. var. *obovatifolia*

**1a. *Psydrax dicocca* var. *dicocca***

假鱼骨木(原变种) *jia yu gu mu* (yuan bian zhong)

*Canthium dicocum* (Gaertner) Merrill; *C. didymum* C. F. Gaertner; *Plectronica dicocca* (Gaertner) Merrill; *P. didyma* (C. F. Gaertner) Merrill.

Leaf blade ovate, elliptic, or ovate-lanceolate. Inflorescences cymose. Stigma entire. Fruit obovoid or obovoid-ellipsoid. Fl. Jan–Aug, fr. Jun–Nov.

Sparse forests or thickets at low to middle elevations; 100–600 m. Guangdong, Guangxi, Hainan, Xizang (Médog), Yunnan [India, Indochina, Indonesia, Malaysia, Philippines, Sri Lanka; Australia].

**1b. *Psydrax dicocca* var. *obovatifolia*** (G. A. Fu) Lantz, **comb. nov.**

倒卵叶假鱼骨木 *dao luan ye jia yu gu mu*

Basionym: *Canthium dicocum* var. *obovatifolium* G. A. Fu, *Bull. Bot. Res.*, Harbin 5(1): 183. 1985.

Leaf blade obovate or ovate-elliptic. Inflorescences fasciculate, 4–6-flowered. Stigma entire or often bifid or emarginate. Fruit subglobose or ellipsoid. Fl. May–Jun.

- Broad-leaved forests. Hainan (Tunchang).

**76. *RICHARDIA*** Linnaeus, *Sp. Pl.* 1: 330. 1753.

墨苜蓿属 *mo mu xu shu*

Chen Tao (陈涛); Charlotte M. Taylor

*Ricardia* Adanson; *Richardsonia* Kunth.

Herbs, annual or perennial, unarmed. Raphides present. Leaves opposite, without domatia; stipules persistent, interpetiolar and fused to petioles or leaf bases, truncate to rounded, setose. Inflorescences terminal, capitate, several to many flowered, pedunculate and enclosed by paired leaflike bracts (or sessile with involucre leaves in other morphological interpretations), bracteate. Flowers sessile, bisexual, monomorphic. Calyx with ovary portion turbinate to globose, limb deeply 4–8-lobed. Corolla white or pink, funnel-form, inside glabrous or pubescent at throat; lobes 4–6, valvate in bud. Stamens 3, 4, or 6, inserted in corolla throat, exserted; filaments developed; anthers dorsifixed near middle. Ovary 3- or 4-celled, ovules 1 in each cell, axile and attached at middle of septum; stigmas 3 or 4, linear or spatulate, exserted. Fruit schizocarpous, subglobose to obovoid or tricocous, dry, bony, with calyx limb deciduous; mericarps 3 or 4, indehiscent, 1-celled with 1 seed, ellipsoid to angled, usually papillose to muricate on dorsal surface (i.e., abaxially) and with 1 or more grooves and sometimes papillose to muricate on ventral surface (i.e., adaxially); seeds medium-sized, ellipsoid to plano-convex; endosperm corneous; cotyledon leaflike; radicle cylindrical, hypogeous.

Fifteen species: widespread in the Antilles and North and South America, three species naturalized in the Old World tropics; two species (both introduced) in China.

As noted by Chaw and Peng (*J. Taiwan Mus.* 40: 71–83. 1987), Asian collections of *Richardia* have long been confused in herb. with various other weedy Rubiaceae. *Richardia* was studied in detail by Lewis and Oliver (*Brittonia* 26: 271–301. 1974). The synonymous name *Richardsonia* has

frequently been used for this genus, including in older references about invasive weeds. H. S. Lo (in FRPS 71(2): 203. 1999) described the flowers as sometimes polygamo-dioecious, but the origin of this description is unknown. Lewis and Oliver did not report this condition, although they did mention that the plants frequently have both chasmogamous and cleistogamous flowers. H. S. Lo also described the anthers as dorsifixed near the base, but other authors have all considered them to be dorsifixed near the middle, which agrees with specimens studied.

*Richardia stellaris* (Chamisso & Schlechtendal) Steudel is naturalized in Australia and perhaps may be expected in China; it can be recognized by its narrowly triangular to narrowly elliptic, sharply acute leaves.

- 1a. Mature mericarps somewhat dorsiventrally flattened, with 2 broad parallel depressions along length of inner (i.e., adaxial) face ..... 1. *R. brasiliensis*  
 1b. Mature mericarps triangular to somewhat rounded, with 1 narrow groove along length of inner (i.e., adaxial) face ..... 2. *R. scabra*

**1. *Richardia brasiliensis*** Gomes, Mem. Ipecacuanha Brasil, 31. 1801.

巴西墨苜蓿 *ba xi mo mu xu*

Herbs, annual, decumbent or suberect, to 80 cm or longer; stems flattened to subterete, hispidulous or scaberulous and hirsute. Petiole 5–10 mm, hispidulous to pilosulous; leaf blade drying membranous to thickly papery, ovate, elliptic, or lanceolate, 1–5 × 0.5–3.5 cm, both surfaces scaberulous to glabrescent, base acute to cuneate, apex acute to obtuse; stipule sheaths 1–3 mm, pilose to pilosulous, with 3–11 setae 2–4 mm. Inflorescences ca. 1 cm in diam. (not including leaflike bracts or subtending leaves). Calyx with ovary portion obovoid, 1–1.5 mm, densely papillose or hispidulous to smooth; lobes 6, lanceolate or narrowly lanceolate, 1.5–3.5 mm, glabrescent, margins ciliate, apex acute. Corolla white, glabrous inside and outside; tube 3–8 mm; lobes 6, 1–3 mm. Fruit with mericarps 3, ellipsoid to obovoid, laterally somewhat dorsiventrally flattened, 2–3 mm, dorsally papillose to subsmooth, ventrally with 2 broad parallel grooves along length of face. Fl. and fr. Feb–Sep.

Wastelands; ca. 300 m. Naturalized in Guangdong and Taiwan [native to South America; adventive and naturalized occasionally throughout Old World tropics].

This species was reported as naturalized in Taiwan by Ou (Bull. Exp. Forest Natl. Chung Hsing Univ. 8: 11–30. 1987, article not seen, cited by Wu et al., *Taiwania* 49: 16–31. 2004) and later by Wu et al. (loc. cit.) but not by other contemporaneous authors (e.g., Chaw &

Peng, *J. Taiwan Mus.* 40: 71–83. 1987). It was not cited at all by H. Y. Liu and T. Y. A. Yang (*Fl. Taiwan*, ed. 2, 4: 245–340. 1998).

**2. *Richardia scabra*** Linnaeus, Sp. Pl. 1: 330. 1753.

墨苜蓿 *mo mu xu*

*Richardia pilosa* Ruiz & Pavon; *Richardsonia scabra* (Linnaeus) A. Saint-Hilaire.

Herbs, annual, decumbent or suberect, to 80 cm or longer; stems flattened to subterete, hirsute. Petiole 5–10 mm, hirsute to glabrescent; leaf blade drying membranous to thickly papery, ovate, elliptic, or lanceolate, 1–5 × 0.5–3.5 cm, both surfaces scabrous to glabrescent, base acute to cuneate, apex acute to obtuse; stipule sheaths 1–4 mm, pilose to pilosulous, with 3–15 setae 2–5 mm. Inflorescences ca. 1 cm in diam. (not including leaflike bracts or subtending leaves). Calyx with ovary portion obovoid, 1–1.5 mm, papillose to hispidulous; lobes 6, lanceolate or narrowly lanceolate, 1.5–3.5 mm, glabrescent, margins ciliate, apex acute. Corolla white, glabrous inside and outside; tube 2–8 mm; lobes 6, triangular, 1–3 mm. Fruit with mericarps 3, ellipsoid to obovoid, in cross-section triangular to somewhat rounded, 2–3.5 mm, dorsally densely papillose to hispidulous, ventrally with 1 narrow groove along length of face. Fl. and fr. Feb–Nov.

Wastelands; sea level to 200 m. Naturalized in Guangdong, Hainan, and Taiwan [native to the Antilles and North and South America; adventive and naturalized occasionally throughout Old World tropics].

H. S. Lo (in FRPS 71(2): 203. 1999) noted that this species was introduced to China in the 1980s.

## 77. RONDELETIA Linnaeus, Sp. Pl. 1: 172. 1753.

郎德木属 *lang de mu shu*

Chen Tao (陈涛); Charlotte M. Taylor

Shrubs or trees, unarmed. Raphides absent. Leaves opposite or rarely verticillate, sometimes with domatia; stipules persistent or caducous, interpetiolar, generally triangular. Inflorescence terminal or infrequently axillary, congested-cymose to paniculate or corymbiform, several to many flowered, pedunculate, bracteate. Flowers sessile to pedicellate, bisexual, distylous. Calyx limb 4- or 5-lobed, with lobes often unequal. Corolla white, yellow, orange, or red, funnelform or salverform with tube often slender and prolonged, inside glabrous or villous, with thickened annular ring at throat; lobes 4 or 5, imbricate in bud, with margins frequently crisped. Stamens 4 or 5, inserted in corolla throat, included or exerted; filaments short or reduced; anthers dorsifixed. Ovary 2-celled, ovules numerous in each cell on axile placentas; stigmas capitate or 2-lobed, included or exerted. Fruit capsular, globose to depressed globose or dicocous, loculicidally dehiscent into 2 valves with these valves often then splitting, woody to papery, with calyx limb persistent; seeds numerous, small, fusiform or discoid, flattened, winged; endosperm fleshy; embryo small, clavate.

About 20 species: tropical America, one species widely cultivated in tropical regions; one species (introduced) in China.

This genus was formerly circumscribed broadly, to include as many as 140 species, but neotropical taxonomists now separate the species formerly treated in *Rondeletia* s.l. into a number of smaller genera, notably *Arachnothryx* Planchon and *Rogiera* Planchon. The cultivated species treated here belongs to *Rondeletia* s.s.

**1. *Rondeletia odorata*** Jacquin, Enum. Syst. Pl. 16. 1760.

郎德木 lang de mu

Shrubs, to 2 m tall; branches flattened to subterete, hirtellous or villosulous to glabrescent. Leaves opposite, decussate; petiole 1–2 mm, hirtellous to glabrescent; blade drying stiffly leathery, ovate, elliptic, or elliptic-oblong, 2–5 × 1–3.5 cm, adaxially scabrous and often rugulose or bullate, abaxially glabrescent to pilosulous or hirtellous at least on principal veins, base obtuse to subcordate, margins thinly revolute, apex broadly obtuse to acute; secondary veins 3–6 pairs, sometimes with pilosulous to pilose domatia; stipules persistent, triangular, 4–5 mm, strigillose to pilosulous, acute. Inflorescences terminal, cymose, several to many flowered, 2–3 × 3–4.5 cm, hirtellous to hirsute; peduncle 0.7–1.5 cm; bracts narrowly triangular

to ovate or elliptic, 2–15 mm, acute; pedicels 1.5–5 mm. Calyx with ovary portion subglobose, 1.5–2 mm, densely strigillose to pilosulous; limb lobed essentially to base; lobes 5, narrowly triangular to linear, 4–5 mm, sparsely strigillose to puberulent. Corolla bright red with yellow throat, salverform, pilosulous to strigillose outside; tube 12–20 mm; lobes suborbicular, ca. 3.5 × 4 mm, crisped, obtuse to rounded. Capsules globose to depressed globose, 3–4 mm in diam., densely hirtellous or villosulous; seeds ca. 0.8 × 0.5 mm. Fl. Jul–Sep.

Cultivated in Fujian, Guangzhou, and Hong Kong [native to Cuba; cultivated sporadically in tropical regions worldwide].

The cultivated plants apparently do not produce fruit; the description of the fruit here is taken from plants in the native range of this species. The few Chinese species seen are all long styled.

**78. ROTHMANNIA** Thunberg, Kongl. Vetensk. Acad. Handl. 37: 65. 1776.

野椴子属 ye zhi zi shu

Chen Tao (陈涛); Charlotte M. Taylor

Shrubs or large trees, unarmed. Raphides absent. Leaves opposite and generally isophyllous or frequently apparently verticillate in whorls of 3 due to marked anisophylly grouping 2 leaves at a node plus an apparently single leaf on a short to reduced axillary branch, sometimes with domatia; stipules persistent, interpetiolar, triangular. Inflorescences terminal or pseudoaxillary, congested-cymose and several flowered or reduced to 1 flower, sessile or pedunculate, bracteate or bracts reduced. Flowers sessile to pedicellate or pedunculate, bisexual, monomorphic. Calyx limb velvety pubescent inside, truncate to 5-lobed. Corolla white to pale green with red or purple to brown spots, narrowly to broadly funnelform or campanulate, often fleshy to leathery, glabrous inside; lobes 5(–7), convolute in bud to left or right depending on species. Stamens 5(–7), inserted in corolla tube, included or partly exerted; filaments short or reduced; anthers dorsifixed. Ovary partially to perhaps completely [1 or]2-celled, ovules numerous on 2 to several large parietal or perhaps sometimes axile placentas; stigma clavate, with receptive surface confined to shortly bilobed apex, exerted or included. Fruit baccate, thickly fleshy to leathery, globose to ellipsoid and sometimes relatively large, smooth or ridged, yellow to brown, with calyx limb persistent; seeds numerous, large, angled to sublenticular, embedded in pulp.

At least 30 species: tropical Africa, Asia, and Madagascar; one species in China.

*Rothmannia* does not seem at all well known in Asia, as to species or generic limits. The distinctive growth form of *Rothmannia*, with some or several nodes bearing apparently unequal and ternate leaves, is due to the development of one very short axillary branchlet that bears one leaf (the other being reduced to absent). The flowers are often if not usually nocturnal. *Rothmannia* has been described by some authors as having a 1-locular ovary with parietal placentas, at least in Africa (Bridson & Verdcourt, Fl. Trop. E. Africa, Rub. (Pt. 2), 511–512. 1988), but the Asian species have 2-celled ovaries with apparently axile placentas (Puff et al., Rubiaceae of Thailand, 60. 2005).

The African species *Rothmannia longiflora* Salisbury is occasionally cultivated in tropical Asia, including Hong Kong (*S. Y. Hu & K. H. Yung* 403, MO!). This species has elliptic leaves that are 6–11 × 3–5 cm and relatively large showy flowers, with the tubular calyx limb 5–10 mm and subtruncate or with small lobes 1–4 mm, and a slenderly funnelform, relatively large corolla with tubes 12–14 cm and lobes 1–4 cm.

**1. *Rothmannia daweishanensis*** Y. M. Shui & W. H. Chen, Novon 13: 322. 2003.

大围山野椴子 da wei shan ye zhi zi

Trees, 10–15 m tall; bark dark gray; branches glabrous, lenticellate. Petiole ca. 3 mm, glabrous; leaf blade drying stiffly papery, greenish brown, ovate to elliptic, 10–14 × 4–5 cm, both surfaces glabrous and shiny, base cuneate to acute and sometimes slightly decurrent, apex acuminate with tip then blunt; secondary veins 5 or 6 pairs; stipules broadly triangular-ovate, 1.5–2 × 2–3 mm, acuminate. Inflorescence terminal or pseudoaxillary, 1-flowered, glabrous; peduncle articulate, basal portion ca. 0.5 cm, apical portion (“pedicel”) 20–25 mm; bracteoles triangular, ca. 1.5 mm, sericeous adaxially, glabrous abaxially. Calyx sparsely sericeous outside; ovary portion ellipsoid, ca. 3 mm; limb with basal tubular portion 2–2.5 mm, inside densely

villous and with short colleters; lobes linear-oblong to spatulate, 14–16 × 0.7–0.9 mm, 1-veined, obtuse. Corolla campanulate, glabrous throughout; tube white outside, inside striate and/or speckled with purple, 50–55 mm, at base with slender portion 6–7 × ca. 5 mm, abruptly dilated above this, ca. 30 mm in diam. at middle; lobes white outside, purple-speckled inside, overlapping to left, broadly ovate, 18–20 × 22–23 mm, obtuse. Ovary with placentas parietal, apparently confluent; style ca. 50 mm; stigmatic portion ca. 20 × 1 mm. Berry ellipsoid becoming subglobose with base swollen-stipitate, 4–5 cm in diam., color inside and out unknown, smooth; seeds ca. 12 × 8 × 4 mm. Fl. Oct–Dec, fr. Dec–Mar.

Rocky crevices in limestone rain forests; 300–600 m. Yunnan (Maguan) [Vietnam].

Shui and Chen described the flowers of this species as being

(paraphrased here) terminal on a reduced branch that is produced in an axillary position. The inflorescence in other species of *Rothmannia* is a congested or reduced cyme generally borne on a short peduncle produced in a terminal or pseudoaxillary position; thus their “reduced

branch” is here treated as being the peduncle (i.e., the structure directly bearing the solitary flower. In general, these structures have been interpreted variously by different authors. Zhang et al. (Acta Phytotax. Sin. 45: 92. 2007) reported this species also from Vietnam.

## 79. RUBIA Linnaeus, Sp. Pl. 1: 109. 1753.

茜草属 qian cao shu

Chen Tao (陈涛); Friedrich Ehrendorfer

Shrubs, subshrubs, or perennial herbs, not rarely clambering or climbing vines or rarely lianas, unarmed; stems often prickly and/or longitudinally ribbed or winged. Raphides present. Leaves opposite and with interpetiolar, triangular or ovate, persistent to caducous (*Rubia siamensis*) or reduced (*R. tibetica*) stipules or with leaflike stipules in whorls of 4, 6, to many in middle stem regions; domatia none; main veins single or 3–5 (or more) and then palmate, secondary veins lateral. Inflorescences thyrsoid, with terminal and/or axillary cymes, usually paniculiform and often expanding from new axes developing with age; individual cymes few to many flowered, pedunculate, bracteate. Flowers pedicellate or sessile, rather small, usually bisexual and monomorphic, rarely polygamo-dioecious (*R. cordifolia*). Ovary inferior (hypanthium), ellipsoid, subglobose, 2-celled, ovules 1 in each cell, erect, axile. Calyx limb reduced and obsolete. Corolla white to cream, yellow, greenish or red to purplish, often turning black when dried, mostly rotate, but rarely also campanulate to funnel-shaped, inside glabrous or infrequently papillose; lobes predominantly 5 (rarely also less or more), valvate in bud, often long acuminate. Stamens usually 5, inserted at corolla base (or tube), exerted; filaments developed to reduced; anthers dorsifixed. Stigmas 2-lobed, included or exerted. Fruit developing into 2 separate or (by reduction) into only 1 subglobose, baccate, berrylike mericarp with fleshy meso- and endocarp, dark red, purple, black, or infrequently orange (*R. cordifolia*), glabrous or somewhat hairy; seeds (“pyrenes”) 2, ellipsoid, subglobose, or plano-convex, with membranous testa; endosperm corneous; embryo subincurved; cotyledons leaflike; radicle prolonged, basiscopic.

About 80 species: extending from tropical and temperate Asia to Japan and Indonesia, through the Himalaya to SW Asia, E to S Africa, through the Mediterranean to W Europe, Macaronesia, and the Azores; locally introduced and persisting from cultivation in Mexico, Chile, and elsewhere; 38 species (20 endemic) in China.

As already mentioned in the present volume under *Galium*, *Rubia* is the type genus of the family, the tribe Rubieae, and the subtribe Rubiinae. As an Old World clade, *Rubia* is related to the Mesoamerican genus *Didymaea* and occupies a relative basal position within Rubiinae: its 5-lobed corollas, fleshy fruit, and always perennial growth form apparently are plesiomorphic features. This and its clear separation from the somewhat more apomorphic *Sherardia-Asperula-Galium* group is well documented by DNA data (Natali et al., Opera Bot. Belg. 7: 193–203. 1996; Soza & Olmstead, Taxon 59: 755–771. 2010). *Rubia* is keyed out from among the other Chinese taxa of Rubieae under *Galium* on p. 107. Its best differential characters are the dominantly 5-merous flowers combined with baccate, berrylike mericarps. The latter also occur independently among New World taxa of *Galium* (and *Relbunium*).

Among the Rubieae tribe *Rubia* (after *Galium* and *Asperula* in their present circumscription) is the third largest and obviously monophyletic genus. Nearly half of its recognized species occur in China. Because of excessive variability, the occurrence of hybridization and polyploidy as well as the lack of detailed studies (particularly on material in the major herbaria of China and elsewhere), our knowledge of *Rubia* is limited and the present treatment of the genus still quite provisional.

More recent taxonomic surveys of *Rubia* are available for the former Soviet Union (Pojarkova, Fl. URSS 23: 382–417. 1958), India (Deb & Malick, Bull. Bot. Surv. India 10(1): 1–16. 1968), Iran (Ehrendorfer et al., Fl. Iranica 176: 48–72. 2005), Bhutan (Long, Edinburgh J. Bot. 53: 108–110. 1996; Long, Fl. Bhutan 2(2): 823–825. 1999), and Taiwan (T. Y. A. Yang, Fl. Taiwan, ed. 2, 4: 321–324. 1998). Particularly in the first of these contributions, but also in the following two, the infrageneric taxonomy of *Rubia* is briefly considered. The majority of the Chinese species are characterized by 3–5(–11) palmate veins in their relatively broad leaves. These taxa correspond to *R.* sect. *Oligoneura* Pojarkova (= *R.* [unranked] *Cordifoliae* Candolle; *R.* sect. *Cordifoliae* (Candolle) K. Schumann ex Deb & Malick). Within this section Pojarkova (loc. cit.) has recognized two series: one predominantly climbing vines with long leaf petioles as *R.* ser. *Cordifoliae* (Candolle) Pojarkova (with 16 species in China; see under *R. cordifolia*), the other mostly erect perennial herbs with very short leaf petioles as *R.* ser. *Chinenses* (with three species in China; see under *R. chinensis*). The latter is close to the informal *R. mandersii* group, where the leaves are sessile (three species in China; see under *R. mandersii*). Finally, there are two species groups with vines. One is the *R. sikkimensis* group with sessile leaves and leaflike stipules (two Chinese species; see under *R. tenuis*), in the other, the *R. siamensis* group, typical (not leaflike) interpetiolar stipules appear between the opposite leaves (four species in China; see under *R. siamensis*).

The remaining ten Chinese species have leaves with only 1(–3) main vein(s) and predominantly pinnate vein branching. In the present treatment this refers to the species *Rubia chitralensis*, *R. deserticola*, *R. dolichophylla*, *R. reznitzenkoana*, *R. schugnanica*, *R. tibetica*, and *R. tinctorum*, here provisionally accommodated in *R.* sect. *Rubia* s.l. (including *R.* sect. *Meganthera* Pojarkova (= *R.* sect. *Rubia* s.s.), *R.* sect. *Campylanthera* Pojarkova, and *R.* sect. *Chonanthe* Pojarkova). The placement of the E Asiatic species *R. haematantha* (the *R. haematantha* group; see there) as well as *R. pseudogalium* and *R. truppeliana* (the *R. truppeliana* group; see there) is doubtful; they may belong to *R.* sect. *Oligoneura* in spite of their very narrow leaves and only 1 main vein. The more detailed infrageneric subdivisions of *Rubia* by Pojarkova listed above have been based on size and form of anthers and other flower details and are in need of more general and detailed study.

Relevant characters for the separation of *Rubia* taxa on the species level are growth habit, indumentum, number, shape and consistency of leaves and stipules, presence or absence of petioles, inflorescence structures, color and morphology of corollas from rotate to funnel-shaped, fruit color, etc. Particularly, leaf characters often vary excessively under different environmental and developmental conditions (e.g., in more widespread taxa as *Rubia cordifolia* and its allies; see further comments there). These facts are difficult to evaluate, at least on dried specimens.

The ground-up rhizomes and roots of *Rubia tinctorum*, the type species of the genus, have long been the source of important red textile dyes (madder red, alizarin, rose madder, alizarin crimson). This use was of course much more important before the invention of aniline dyes (e.g., madder colored the red coats of the 18th-century British army). Nevertheless, *R. tinctorum* is still widely cultivated at a local scale and used, in particular, to color wool for handmade oriental rugs in C and SW Asia (Murphy, Root of Wild Madder, 1–297. 2005) but also in fine art painting. The worldwide occurrence, cultivation, chemistry, and cultural role of this species was discussed in detail by Chenciner (Madder Red. 2000). The stems of *R. manjith* are also used to produce a red dye (fide Long, loc. cit. 1999).

The key here generally follows that of H. S. Lo (in FRPS 71(2): 287–290. 1999), with the measurements updated from the descriptions and species added as appropriate.

- 1a. Leaves with only 1 evident midvein; lateral veins pinnate, when palmate weak and obscure.
- 2a. Leaves linear to narrowly lanceolate or oblong, mostly 3.5–30 × as long as wide.
- 3a. Leaves with well-developed petioles; plants of forests.
  - 4a. Leaves in whorls of up to 6–8, with petioles 6–35 mm; peduncles 10–40 mm; corolla lobes ca. 2 mm; Shandong ..... 36. *R. truppeliana*
  - 4b. Leaves in whorls of never more than 4, with petioles 3–6 mm; peduncles 3–6 mm; corolla lobes 1.2–1.5 mm; Yunnan ..... 24. *R. pseudogalium*
- 3b. Leaves without distinct petioles, sessile to subsessile; plants of open habitats.
  - 5a. Corolla dark red or perhaps sometimes white; leaves 6–8 per whorl, narrowly linear, less than 1 mm wide, midvein without evident lateral veins ..... 12. *R. haematantha*
  - 5b. Corolla yellow or white; leaves 4–6 per whorl, linear-lanceolate to lanceolate-oblong, wider than 1 mm.
    - 6a. Leaves 5–14 mm wide, midvein with pinnate lateral veins; stems with aculeolate angles; inflorescence cymes terminal and distributed along lower stem nodes; corolla lobes ca. 2 mm ..... 8. *R. dolichophylla*
    - 6b. Leaves 20–50 mm wide, lateral veins not evident; stems smooth; inflorescence cymes clustered near stem apices; corolla lobes 2.3–2.7 mm ..... 28. *R. schugnanica*
- 2b. Leaves broadly (ob)lanceolate, lanceolate-oblong, ligulate, elliptic, elliptic-oblong, lanceolate-ovate, ovate, or broadly ovate, mostly 1–3.5 × as long as wide.
  - 7a. Corolla lobes with apex aristate, arista 0.5–0.8 mm; leaves 4–6 in a whorl, lanceolate or elliptic-oblong, drying firmly leathery ..... 7. *R. deserticola*
  - 7b. Corolla lobes obtuse, acute, or acuminate to mucronate, with arista up to 0.4 mm; leaves lanceolate to broadly ovate, drying papery to leathery.
    - 8a. Larger leaves longer and wider than 3 × 1.5 cm, dried papery to subleathery.
      - 9a. Leaves dried papery; corolla limb 6–7.5 mm in diam.; anthers ca. 0.4 mm ..... 4. *R. chitralensis*
      - 9b. Leaves dried papery to subleathery; corolla limb 3–4.5 mm in diam.; anthers ca. 0.6 mm ..... 34. *R. tinctorum*
    - 8b. Leaves 0.5–3 × 0.2–1.5 cm, dried leathery.
      - 10a. Leaves and leaflike stipules similar, mostly up to 6 per whorl; lower nodes of older stems not sheathed with old leaf bases; corolla yellow, lobes often 4, obtuse with short incurved cusp ..... 26. *R. reznitzenkoana*
      - 10b. Leaves 2 with 2 smaller leaflike interpetiolar stipules in whorls of 4; lower nodes of older stems shortly sheathed with membranous bases of old leaves; corolla whitish, lobes usually 5, acuminate ..... 33. *R. tibetica*
- 1b. Leaves with 3–11 evident principal and palmate veins (including midrib), arising from at or near base.
  - 11a. Leaves opposite, with evident interpetiolar stipules; plants of moist forests.
    - 12a. Leaves tuberculate-hispidulous; stipules ± leaflike but smaller than true leaves ..... 6. *R. crassipes*
    - 12b. Leaves glabrous, scabrous, or ± hairy; stipules ovate to triangular, very different from true leaves.
      - 13a. Leaf margins entire and smooth, petioles 0.3–2.5 cm; inflorescence axes slender and filiform ..... 11. *R. filiformis*
      - 13b. Leaf margins aculeolate, petioles (1–)2–4(–8) cm; inflorescence axes stout.
        - 14a. Ovary and fruit densely hairy ..... 10. *R. falciformis*
        - 14b. Ovary and fruit glabrous.
          - 15a. Stipules large, ovate, acuminate, (5–)12–35(–60) × (3–)8–25(–40) mm; dried leaves light green and ± ferruginous, particularly below and on main veins ..... 15. *R. magna*
          - 15b. Stipules small, triangular, 3–5(–7) × 2–3 mm; dried leaves dark green ..... 30. *R. siamensis*
  - 11b. Leaves and leaflike stipules similar, in whorls of 4–12; plants of various habitats.
    - 16a. Erect herbs, if ± climbing vines then leaves (sub)sessile; leaves and leaflike stipules 4 or sometimes 6 per whorl.
      - 17a. Leaves markedly cordate at base.
        - 18a. Older stems broadly 4-winged ..... 25. *R. pterygocaulis*
        - 18b. Older stems quadrangular to narrowly 4-angled.
          - 19a. Stem angles retrorsely aculeate; mountains of Taiwan ..... 2. *R. argyi*
          - 19b. Stem angles smooth; Sichuan ..... 13. *R. latipetala*
      - 17b. Leaves cuneate, obtuse, truncate, rounded, or shallowly cordulate at base.

- 20a. Leaves sessile or subsessile (if flowers 4-merous then see *Galium*).
- 21a. Principal leaf veins 7–11; stems and leaves strongly hairy; fused basal part of corolla only 0.2–0.3 mm, lobes 1–1.2 mm ..... 23. *R. polyphlebia*
- 21b. Principal leaves veins 3 or 5; stems and leaves ± glabrescent to glabrous, scabrous; fused basal part of corolla 0.5–0.6 mm.
- 22a. Slender vines; leaves drying papery; flowers ca. 3 mm in diam. .... 32. *R. tenuis*
- 22b. Erect to spreading herbs; leaves drying mostly ± leathery; flowers 3–5 mm in diam.
- 23a. Stems 8-ribbed; leaves lanceolate to lanceolate-elliptic, 4–7 cm ..... 9. *R. edgeworthii*
- 23b. Stems 4-angled; leaves broadly elliptic, linear-lanceolate, ovate, obovate, or elliptic-oblong, 1–5 cm.
- 24a. Stems and leaves glabrous to scabrous, latter drying papery; principal main veins 5; corolla ca. 5 mm in diam. .... 16. *R. mandersii*
- 24b. Stems and leaves often ± hairy or scabrous, latter drying ± papery; principal veins 3–5; corolla ca. 3 mm in diam. .... 38. *R. yunnanensis*
- 20b. Leaves petiolate, petioles 0.3–9 cm.
- 25a. Stems clearly retrorsely aculeolate.
- 26a. Leaves suborbicular to ovate, length/breadth index 1–1.8, dried papery ..... 2. *R. argyi*
- 26b. Leaves lanceolate to ovate, length/breadth index 2–3, dried papery to subleathery ..... 22. *R. podantha*
- 25b. Stems smooth to sparsely scaberulous.
- 27a. Leaves ± broadly elliptic, principal veins 5–7, dried thinly papery; fused part of corolla 0.2–0.6 mm ..... 3. *R. chinensis*
- 27b. Leaves broadly lanceolate to ± broadly ovate, principal veins 3–5, dried papery to subleathery; fused part of corolla 0.8–2 mm.
- 28a. Leaves ± broadly ovate, length/breadth index 1.2–1.5, base cordulate to cordate, dried papery, principal veins 3–5; fused part of corolla 1.5–2 mm ..... 13. *R. latipetala*
- 28b. Leaves broadly lanceolate to ovate, length/breadth index 1.5–2.5, base obtuse, rounded, or cordulate, dried thickly papery to subleathery, principal veins often impressed; fused part of corolla 0.8–1 mm ..... 29. *R. schumanniana*
- 16b. Vines or lianas, climbing to sprawling; leaves petiolate, petioles 0.1–12 cm.
- 29a. Fruit, stems, and leaves hirsute, strigillose, hirtellous, or villosulous ..... 35. *R. trichocarpa*
- 29b. Fruit glabrous, stems and leaves glabrous or with diverse indumentum.
- 30a. Leaves 4–12 per whorl, at least middle stem nodes with 6 or more leaves.
- 31a. Leaves oblanceolate, base cuneate to acute; petioles 0.6–3.5 cm ..... 36. *R. truppeliana*
- 31b. Leaves ovate to suborbicular or lanceolate to oblong-lanceolate, base truncate, rounded, cordulate, or cordate; petioles 1–11 cm.
- 32a. Leaves ovate to suborbicular, largest mostly longer than 4 cm, length/breadth index 1.2–1.5, base cordulate or cordate; petioles 2–11 cm ..... 31. *R. sylvatica*
- 32b. Leaves lanceolate to oblong-lanceolate, largest mostly shorter than 4 cm, length/breadth index 2.5–4, base truncate, rounded, or cordulate to cordate; petioles 1–9 cm ..... 5. *R. cordifolia*
- 30b. Leaves 4, very rarely more per whorl.
- 33a. Stems, leaves abaxially, and/or outside of corolla moderately to densely hirtellous or hispidulous with trichomes regularly hooked at apex; leaves small, 0.8–3.5 × 0.3–1.5 cm ..... 19. *R. oncotricha*
- 33b. Stems, leaves, and corollas outside glabrous, or with diverse indumentum, but never with regularly hooked hairs; leaves larger, 0.7–13 × 0.3–6.5 cm.
- 34a. Leaves drying thickly leathery, oblong-ovate to elliptic, apex obtuse ..... 6. *R. crassipes*
- 34b. Leaves drying papery to leathery, ovate, oblong-lanceolate, ovate-lanceolate, oblong-ovate, cordiform, suborbicular, or lanceolate, apex subacute, acuminate, caudate, or obtuse and cuspidate.
- 35a. Dried plants flushed with red, particularly on lower leaf side; corolla rotate, purplish red, red, or orange, with spreading lobes of 1.2–1.5 mm; mature fruit dark red ..... 17. *R. manjith*
- 35b. Dried plants green, gray, or yellowish (if rarely flushed with red then corollas campanulate with reflexed lobes); corolla white, yellow, greenish, or red; mature fruit black, dark blue, or orange.
- 36a. Corollas (sub)campanulate, tube (0.5–)0.8–1.2 mm, lobes ± reflexed, 1.2–1.5 mm.
- 37a. Stems 4-ridged to markedly winged; leaves lanceolate, length/breadth index more than 3 ..... 1. *R. alata*
- 37b. Stems quadrangular but never winged; leaves broader, length/breadth index less than 3.
- 38a. Leaves of main stems ovate-cordiform to suborbicular-cordiform, ± as long as wide or slightly longer than wide, when dry adaxially mealy green or pale green ..... 20. *R. ovatifolia*
- 38b. Leaves lanceolate, oblong-ovate, oblong-suborbicular, or ovate, 2–3 × as long as wide, when dry green, brownish green, black, or perhaps red ..... 22. *R. podantha*

- 36b. Corollas rotate, fused part 0.2–0.5 mm, lobes ± spreading.
- 39a. Corollas purplish red, with lobes 3–4 mm ..... 18. *R. membranacea*
- 39b. Corollas white, yellow, greenish yellow, or purplish red, with lobes 1–2.5 mm.
- 40a. Corollas pale yellow to white, with lobes 2–2.5 mm ..... 21. *R. pallida*
- 40b. Corolla variously colored, with lobes 1–1.5 mm.
- 41a. Leaves linear to narrowly lanceolate, 5–10 × as long as wide ..... 27. *R. salicifolia*
- 41b. Leaves broader, oblong-lanceolate, oblong-ovate, ovate, cordiform, or suborbicular, not more than 4 × as long as wide.
- 42a. Leaves ovate to suborbicular, length/breadth index 1–1.8, base cordate or cordulate.
- 43a. Largest leaves mostly shorter than 4 cm, usually cuspidate or apiculate toward apex, length/breadth index 1–1.8, drying ± thickly papery, blackening, with lateral veins usually ± impressed and tertiary venation visible; petioles 0.5–5 cm ..... 2. *R. argyi*
- 43b. Largest leaves mostly longer than 4 cm, usually attenuate toward apex, length/breadth index 1.2–1.5, drying thinly papery, often remaining greenish, lateral veins never impressed and tertiary venation less visible; petioles 2–11 cm ..... 31. *R. sylvatica*
- 42b. Leaves lanceolate to oblong-lanceolate, attenuate toward apex, length/breadth index 2.5–4, lateral veins never impressed and tertiary venation less visible, base truncate, rounded, or cordulate.
- 44a. Flowers white; Taiwan ..... 14. *R. linii*
- 44b. Flowers purplish red, greenish, yellowish, or white; mainland.
- 45a. Stems smooth or sparsely aculeolate; flowers purplish red, greenish yellowish, or whitish; fruit 3.5–4 mm in diam., black at maturity ..... 37. *R. wallichiana*
- 45b. Stems rather markedly or sparsely aculeolate; flowers greenish, yellowish, or whitish; fruit 4–6(–7) mm in diam., orange at maturity ..... 5. *R. cordifolia*

**1. *Rubia alata*** Wallich in Roxburgh, Fl. Ind. 1: 384. 1820.

金劍草 jin jian cao

*Rubia cordifolia* Linnaeus var. *longifolia* Handel-Mazzetti;  
*R. lanceolata* Hayata.

Climbers and vines, herbaceous, perennial; stems to 4 m, quadrangular, 4-ridged, or usually 4-winged at least when older with wings to 1.5 mm wide, glabrous or hirtellous-puberulent at nodes, retrorsely aculeolate. Leaves and leaflike stipules in whorls of 4, often unequal (stipules smaller); petiole 0.2–10 cm, on principal axes longer than on lateral ones, those of stipules often shorter or even lacking; blade drying thinly leathery, linear-lanceolate or narrowly lanceolate, 3.5–9 × 0.4–2 cm, with length/breadth index above 3, glabrous and smooth or sometimes sparsely scaberrulous, base rounded to cordulate, margin thinly revolute and usually aculeolate, apex acute; principal veins palmate, 3(or 5) with lateral veins sometimes weakly evident. Inflorescences thyrsoid, paniculate, with terminal and axillary, many-flowered cymes; axes smooth to aculeolate, ridged to thinly winged; bracts elliptic to lanceolate-elliptic, 0.8–3 mm; pedicels 1–4 mm. Ovary ca. 0.7 mm, smooth. Corolla white, pale yellow, or greenish, campanulate, fused base 0.5–1 mm, glabrous; lobes triangular to lanceolate, 1.2–1.5 mm, apex caudate-acuminate. Mericarp berry black, 5–7 mm. Fl. May–Aug, fr. Aug–Nov.

Forest margins on mountain slopes, thickets; 600–2000 m. Provinces south of the Chang Jiang, east to Taiwan, west to Sichuan, north to C Henan and S Shanxi: Anhui, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Henan, Hubei, Jiangxi, Shaanxi, Sichuan, Yunnan, Zhejiang [Nepal].

*Rubia alata*, an obvious member of *R. ser. Cordifoliae*, is here treated in the sense of H. S. Lo (in FRPS 71(2): 312, t. 70, f. 1–6. 1999),

which may or may not correspond to its original application and its type. Accordingly, it is mainly characterized by relatively narrow leaves, petioles frequently bent near the base of the blade, stem angles with thin ridges to narrow or remarkably well-developed wings, and paniculate inflorescences, small flowers, and black fruit similar to other species of the *R. cordifolia* group (see additional comments under that species). The protologue of *R. alata* does not address the shape of the leaves and describes the stems as winged or not. This suggests the possibility that that the type's leaves are not markedly narrower and its stems not more markedly winged than those of *R. cordifolia* and related species. *Rubia alata* was not treated by Deb and Malick (Bull. Bot. Surv. India 10(1): 1–16. 1968) for India, nor by Long (Fl. Bhutan 2(2): 823–825. 1999) for Bhutan. The Kew Rubiaceae checklist (Govaerts et al., World Checkl. Rubiaceae; <http://www.kew.org/wcsp/rubiaceae/>; accessed on 15 Sep 2010) considers it to be a synonym of *R. cordifolia* but gives no source for this conclusion. From the relatively abundant herbarium material studied and the rather narrow species concept used in the present treatment, we believe that it is justified to distinguish *R. alata* sensu H. S. Lo and *R. cordifolia* s.s.

*Rubia lanceolata* from Taiwan is provisionally referred here as a synonym to *R. alata*. Some of the named varieties of *R. cordifolia* may also belong to this species but a clarification is impossible with our present insufficient knowledge of *R. ser. Cordifoliae*. The herbarium name "*R. cordifolia* var. *stenophylla* Franchet" does not appear to have ever been published anywhere.

The numerous collections from the Biodiversity Survey of the Gaoligong Shan area in Yunnan have revealed the common occurrence of *Rubia alata* and the presence of rare *R. siamensis* together with many populations, which link these two quite different taxa. These intermediates exhibit most varied differential character recombinations of the two species with respect to leaf shape, from broadly lanceolate to cordate (length/breadth index below 3) or from small triangular and sessile stipules to fully leaflike elements with long petioles. In addition, new characters appear, such as greenish to yellowish fruit colors. The suspicion that all this is the result of hybridization needs support by further studies.

**2. *Rubia argyi*** (H. Léveillé & Vaniot) H. Hara ex Lauener & D. K. Ferguson, Notes Roy. Bot. Gard. Edinburgh 32: 114. 1972.

东南茜草 *dong nan qian cao*

*Galium argyi* H. Léveillé & Vaniot, Bull. Soc. Bot. France 55: 58. 1908; *Rubia akane* Nakai; *R. akane* var. *erecta* Masamune; *R. chekiangensis* Deb.

Vines, herbaceous, perennial (rarely erect in mountains of Taiwan: *Rubia akane* var. *erecta*); stems probably to 2 m or more, quadrangular to narrowly 4-winged especially when older, glabrous to pilosulous, retrorsely aculeolate sometimes becoming smooth with age. Leaves nearly exclusively in whorls of 4, equal or sometimes unequal; petiole 0.5–5 cm; blade when drying often blackening, ± thickly papery, suborbicular-cordiform, broadly ovate-cordiform, or oblong-suborbicular, (1–)2–4.5(–5) × (1–)1.5–3.5(–4) cm, length/breadth index 1–1.8, glabrous or sparsely to densely pilosulous or hirtellous, scaberulous, base cordate to cordulate, margins sparsely to densely retrorsely aculeolate, apex cuspidate to apiculate; principal veins palmate, 5 or 7, veins usually ± impressed and tertiary venation visible. Inflorescences thyrsoid, paniculate, with terminal and axillary, many-flowered cymes, axes aculeolate, glabrous to pilosulous; bracts lanceolate or lanceolate-elliptic, 1–4 mm; pedicels rather stout, 1–2.5 mm. Ovary ca. 0.8 mm, smooth. Corolla yellowish-greenish to white, rotate to bell-shaped, glabrescent, fused base 0.5–0.7 mm; lobes lanceolate, 1.3–1.4 mm, spreading to ± reflexed. Mericarp berry black, subglobose 5–7(–9) mm in diam. Fl. Jul–Oct, fr. Aug–Nov.

Forest margins, thickets, fences at village sides; 300–3400 m. Anhui, Fujian, Guangdong, Guangxi, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Shaanxi, Sichuan, Taiwan, Zhejiang [Japan, Korea].

*Rubia akane* is here treated as a synonym of *R. argyi*, following the Kew Rubiaceae checklist (Govaerts et al., World Checkl. Rubiaceae; <http://www.kew.org/wcsp/rubiaceae/>; accessed on 15 Sep 2010), Yamazaki (Fl. Japan 3a: 232. 1993), and H. S. Lo (in FRPS 71(2): 316. 1999). The recent Taiwanese flora (T. Y. A. Yang, Fl. Taiwan, ed. 2, 4: 322. 1998), however, continues to regard *R. akane* as a separate species and characterizes it by white flowers, whereas *R. argyi* generally is regarded as yellowish-greenish flowering. Aside from corolla color, no differential characters are apparent between the two taxa. However, in addition to the typical climbing and vinelike “var. *akane*” in Taiwanese localities below 2000 m, at higher elevations and more open habitats of the Taiwanese mountains, there is an upright growing type called *R. akane* var. *erecta*, which seems to be endemic. As a species it has been called *R. nankotaizana* Masamune (Hokuriku J. Bot. 2: 40. 1953). If it is actually conspecific, it should be transferred as a variety to *R. argyi*.

*Rubia argyi* belongs to *R. ser. Cordifoliae* and is well illustrated in the FRPS treatment by H. S. Lo (loc. cit.: 317, t. 71, f. 1–6). With the differential characters available (mainly the relatively broad and short leaves with veins impressed), it can be separated rather clearly from the very closely related members *R. cordifolia* s.l. (or better *R. cordifolia* agg., see there). To lump it with *R. cordifolia* (e.g., Z. Ying Zhang, Fl. Tsinling. 1(5): 14. 1985) does not appear justified. Within the *R. cordifolia* agg. *R. argyi* comes closest to *R. sylvatica*, from which it deviates primarily by its larger leaves, partly in whorls of more than 4. *Rubia ovatifolia* can be separated by its definitely campanulate flowers with a fused base of 0.8–1 mm. For additional comments see under *R. cordifolia*.

**3. *Rubia chinensis*** Regel & Maack in Regel, Tent. Fl. Ussur. 76. 1861.

中国茜草 *zhong guo qian cao*

Herbs, perennial, rhizomatous; stems erect, to 60 cm tall, solitary or usually grouped, unbranched or few branched, quadrangular, glabrous to pilosulous at least near nodes, ribs rounded, smooth to sparsely scaberulous. Leaves in whorls of 4; petiole (0.3–)0.5–2 cm; blade drying thinly papery, ovate, oblong-ovate, or broadly elliptic, 3–10 × 1.2–4.5 cm, length/breadth index 1.8–2.3, adaxially subglabrous and scaberulous, abaxially glabrous to pilosulous, base obtuse, rounded, or cordulate, margin scaberulous to ciliate, apex acute or acuminate; principal veins 5 or 7, palmate. Inflorescences thyrsoid, terminal and axillary in upper nodes, paniculate, many flowered, 5–30 cm, glabrous to pilosulous; axes scaberulous to smooth; bracts lanceolate, 1.5–8 mm; pedicels 2–7 mm. Ovary ca. 0.8 mm, smooth to scaberulous. Corolla greenish white, rotate, 3–4 mm in diam., glabrous, with fused base 0.2–0.6 mm; lobes 5, lanceolate, 1.7–2 mm, acute to caudate. Mericarp berry black, ca. 4 mm in diam., smooth. Fl. May–Jul, fr. Sep–Oct.

Forests on mountains, forest margins, meadows; 200–1400 m. E and N China [Japan, Korea, Russia].

*Rubia chinensis* and a few related species with erect (not climbing) stems and broad leaves with short petioles have been placed by Pojarkova (Fl. URSS 23: 391–392. 1958) into *R. ser. Chinenses*. Other Chinese species of this group include the closely related *R. latipetala* and *R. schumanniana*. The *R. mandersii* species group (see there) is similar but has sessile leaves.

For *Rubia chinensis* H. S. Lo (in FRPS 71(2): 301, t. 66, f. 8–13. 1999) gives good drawings and differentiates two varieties (elsewhere also treated as forms). They are listed here for reference but apparently are not well marked in China. They were not included in the Fl. Hebei. (2: 577. 1988), and in Fl. Japan (Yamazaki, 3a: 231–232. 1993) they were synonymized and said to be difficult to distinguish. Generally, it appears that Japanese populations of *R. chinensis* have somewhat smaller leaves than those from China.

- 1a. Leaves adaxially subglabrous or hirtellous along principal veins, pilosulous abaxially ..... 3a. var. *chinensis*  
 1b. Leaves glabrous or aculeolate along midvein ..... 3b. var. *glabrescens*

### 3a. *Rubia chinensis* var. *chinensis*

中国茜草(原变种) *zhong guo qian cao* (yuan bian zhong)

*Rubia mitis* Miquel.

Leaves subglabrous or hirtellous adaxially along principal veins, abaxially pilosulous, margin ciliate.

E and N China [Japan, Korea, Russia].

**3b. *Rubia chinensis* var. *glabrescens*** (Nakai) Kitagawa, Lin. Fl. Manshur. 405. 1939.

无毛大砧草 *wu mao da zhen cao*

*Rubia mitis* f. *glabrescens* Nakai, J. Jap. Bot. 14: 115. 1938; *R. chinensis* f. *glabrescens* (Nakai) Kitagawa.

Leaves glabrous except aculeolate adaxially along mid-vein, abaxially glabrous, margin scaberulous.

NE China [Japan, Korea].

**4. *Rubia chitralensis*** Ehrendorfer, *Nytt Mag. Bot.* 3: 228. 1954.

高原茜草 gao yuan qian cao

Herbs, perennial, with woody rootstock; stems up to 50 cm tall, clustered, subterete to slightly winged, glabrous, smooth. Leaves in whorls of up to 6 (or 7), sessile; blade drying membranous, lanceolate-ovate to lanceolate, (2–)4–5 × 0.7–1.5 cm, adaxially glabrous or sparsely antrorsely scaberulous, abaxially glabrous with midrib antrorsely aculeolate, margins retrorsely scaberulous, apex acute to acuminate; principal vein 1, lateral veins 2, weak. Inflorescences terminal, pyramidal, leaf-like, with 1- to several-flowered cymes; peduncles glabrous, smooth; bracts elliptic to ovate, 6–7 mm; pedicels 2–6 mm. Ovary 1–2 mm, glabrous. Corolla yellowish green to whitish yellow, rotate, 6–7.5 mm in diam., fused basal part 0.5–0.7 mm; lobes lanceolate, ca. 3 mm, acuminate to incurved-mucronate, arista to ca. 0.8 mm. Mericarp berry black and shiny, 3.5–5 mm in diam., glabrous. Fl. Jun–Jul, fr. Jul–Oct.

Stony slopes in *Juniperus* and subalpine belt; ca. 2900[–4000] m. Xinjiang [Afghanistan, Pakistan, Tajikistan, Uzbekistan].

*Rubia chitralensis* is distantly related to other SW to C Asiatic but rather subshrubby taxa, as *R. gedrosiaca* Bornmüller, *R. laxiflora* Gontscharov, or *R. tibetica*. These taxa were placed by Pojarkova (Fl. URSS 23: 398–417. 1958) into several series of the heterogeneous *R. sect. Campylanthera*, distributed from C Asia to the Mediterranean.

**5. *Rubia cordifolia*** Linnaeus, *Syst. Nat.*, ed. 12, 3: 229. 1768.

茜草 qian cao

*Rubia cordifolia* var. *coriacea* Z. Ying Zhang; *R. cordifolia* subsp. *pratensis* (Maximowicz) Kitamura; *R. cordifolia* var. *pratensis* Maximowicz; *R. cordifolia* var. *rotundifolia* Franchet; *R. pratensis* (Maximowicz) Nakai.

Vines, herbaceous, climbing or scrambling herbs, with red rhizomatous base and roots; stems to 3.5 m, several to many from base, often much branched, quadrangular, glabrous to puberulent, with ribs rounded to thinly winged, sparsely to densely retrorsely aculeolate. Leaves in whorls of 4 or more (up to 8 or rarely 12); petiole (1–)1.5–3(–6) cm; blade drying papery to thickly papery, usually remaining ± greenish, lanceolate, oblong-lanceolate, ovate, or oblong-ovate, (1–)1.5–4(–7) × (0.3–)0.5–1.5(–2.5) cm, length/breadth index mostly 2.5–4, glabrous to pilosulous or hirtellous, sparsely to densely scaberulous, base rounded, truncate, cordulate, or cordate, margin serrulate-aculeolate, apex obtuse and apiculate to acute or acuminate; principal veins 3 or 5, palmate. Inflorescences thyrsoid, paniculate, with terminal and axillary, several- to many-flowered cymes; axes glabrous to puberulent or pilosulous, ± aculeolate; bracts linear-lanceolate to ligulate, 1–3 mm; pedicels 1–4 mm. Ovary 0.5–0.8 mm, smooth to scaberulous. Flowers hermaphroditic (rarely polygamo-dioecious?). Corolla pale yellow or greenish yellow, rotate, glabrous, fused base 0.2–0.4 mm; lobes lanceolate, spreading to reflexed, 1.2–1.5 mm, cau-

date. Mericarp berry becoming orange then apparently black, 4–6 mm in diam. Fl. Aug–Sep, fr. Oct–Nov.

Sparse forests, forest margins, grasslands; 300–2800 m. Anhui, Gansu, Hebei, Hunan, Qinghai, Shandong, Shanxi, Sichuan, Xizang, Yunnan [Japan, Korea, Mongolia, Russia (Far East); S and SE Asia to Sri Lanka and Java, through the Himalaya to Afghanistan; (sub)tropical Africa].

As noted by most previous authors (Pojarkova, Fl. URSS 23: 387–391. 1958; Ehrendorfer et al., Fl. Iranica 176: 52–53. 2005), the plants included in *Rubia cordifolia* s.l. comprise a geographically very widespread (from E and SE Asia to Afghanistan, from Sudan to S Africa), morphologically extremely “polymorphic,” polyploid, and still most insufficiently understood racial complex. Its populations, together with related taxa, have been grouped into *R. ser. Cordifoliae* by Pojarkova (loc. cit.), characterized by their generally clambering to climbing habit; leaves and leaflike stipules in whorls of 4 or more, petiolate, palmately 3–7-veined; and corollas rotate to shortly campanulate, with anthers ellipsoid, somewhat curved, and 4–6 × shorter than the corolla lobes. Depending on narrow or wider species concepts and differential characters chosen, the elements of this series have been quite variously treated. In the present flora the following 16 species are assembled in *R. ser. Cordifoliae*: 1. *R. alata*, 2. *R. argyi*, 5. *R. cordifolia*, 6. *R. crassipes*, 14. *R. linnii*, 17. *R. manjith*, 18. *R. membranacea*, 19. *R. oncotricha*, 20. *R. ovatifolia*, 21. *R. pallida*, 22. *R. podantha*, 25. *R. pterygocaulis*, 27. *R. salicifolia*, 31. *R. sylvatica*, 35. *R. trichocarpa*, and 37. *R. wallichiana*. Species 5, 14, 20, 31, and 37 are so close and linked by occasional intermediates that they can be understood as *R. cordifolia* s.l. or *R. cordifolia* agg. The above species description refers to *R. cordifolia* s.s.

The type specimen of *Rubia cordifolia* in the Linnaean Herbarium (no. 131.7, LINN) has no flowers or fruit, but its distinct habit with leaves in whorls of 4, oblong-cordate, acute, and with long petioles corresponds to the above description of the species in a more narrow sense and to the figure in H. S. Lo (in FRPS 71(2): 307, t. 68, f. 7–12. 1999). The complications in the typification of *R. cordifolia* have been detailed by Jarvis (Order Out of Chaos, 800. 2007). The description by Linnaeus was emended by Gaertner (Novi Comment. Acad. Petrop. 14(1): 541. 1770). The original reference to “4-merous flowers” may have been due to the occasional occurrence of 4- among the typical 5-merous flowers or simply to a mistake. The fruit were originally described as unknown, but later their color was given as red. Pojarkova (loc. cit.: 466–467) noted for *R. cordifolia* and for *R. ser. Cordifoliae* as a whole that the fruit were orange or brownish when immature and black when fully mature and dry. Personal observations revealed a group of distinctive Chinese specimens with vegetative parts drying yellowed and the mature, or near-mature, fruit drying clear bright orange but evidently turning black at maturity (e.g., *Fu Kunjun 10394*, MO!). Thus, fruit color may be of taxonomic relevance in *Rubia* but is in need of more detailed studies.

Even with the present, rather narrow circumscription, there is still much variation among the Chinese populations of *Rubia cordifolia*. This refers to indumentum, consistency, shape and size of leaves, number of leaves and leaflike stipules per whorl, flower shape, and fruit color. Leaf indumentum does not seem to be correlated with that of the inflorescence axes. Instead, either may be glabrous or pubescent, apparently independently, which is unusual in Rubiaceae. In zones of contact, particularly with the closely related *R. sylvatica* and *R. ovatifolia*, one has to expect transitional individuals. The status of *R. wallichiana* (see there) and its separation from *R. cordifolia* is doubtful anyway.

The infraspecific synonymy of *Rubia cordifolia* listed above follows H. S. Lo (loc. cit.: 315); it has not yet been checked in detail for lack of any more authoritative treatment of *R. ser. Cordifoliae*. *Rubia cordifolia* var. *coriacea* was not listed by H. S. Lo and is here synony-

mized provisionally, as we have seen no authentic material. According to its protologue, it differs from typical *R. cordifolia* in its subleathery leaves, which are glabrous below. With respect to *R. cordifolia* var. *munjista* (Roxburgh) Miquel see *R. manjith*.

**6. *Rubia crassipes*** Collett & Hemsley, J. Linn. Soc., Bot. 28: 68. 1890.

厚柄茜草 hou bing qian cao

Vines, herbaceous, climbing, to 3 m; stems quadrangular becoming subterete, tuberculate-hispid, scabrous. Leaves in whorls of 4, often  $\pm$  unequal; petiole 0.5–1.8 cm or smallest leaves sometimes subsessile; blade drying thickly leathery, ovate-oblong to elliptic, (0.7–)2–4.5 cm, tuberculate-hispid, base rounded to cordulate, margin slightly revolute, apex obtuse; principal veins 5, palmate. Inflorescences thyrsoid, paniculate, 3–7 cm, with axillary and terminal cymes; axes rather stout; bracteoles ovate or lanceolate, 2.5–3.5 mm. Flowers unknown. Immature mericarp berry black when dry, ca. 4 mm in diam. Fr. autumn.

Forest margins on mountain ridges; 1400–2400 m. Yunnan [Myanmar, Thailand].

We have seen no authentic material of *Rubia crassipes*. The above description corresponds to the protologue and to H. S. Lo (in FRPS 71(2): 313. 1999). The extended description and photo of plants from Thailand regarded as this species by Puff (Fl. Thailand: Rubiaceae; [http://homepage.univie.ac.at/christian.puff/FTH-RUB/FTH-RUB\\_HOME.htm](http://homepage.univie.ac.at/christian.puff/FTH-RUB/FTH-RUB_HOME.htm); accessed on 5 Oct 2010) deviates by straight and soft hairs in addition to the scabrous indumentum and considerably larger leaves. Puff also added data on the shallowly campanulate, 5-lobed flowers 2.4–4 mm in diam., and considered the taxon as part of the *R. cordifolia* group. Only further extensive studies will clarify the doubtful delimitation and taxonomic placement of *R. crassipes*.

**7. *Rubia deserticola*** Pojarkova in Schischkin, Fl. URSS 23: 722. 1958.

沙生茜草 sha sheng qian cao

Plants herbaceous, perennial, with woody rootstock; stems suberect, to 1 m tall quadrangular, angles recurved prickly. Leaves in whorls of 4–6, subsessile; blade drying firmly leathery, lanceolate to elliptic-oblong, aculeolate abaxially on midrib and along thickened margins, base acute, apex acuminate; principal vein 1. Inflorescences terminal, many flowered, leafy and bracteose. Ovary 1–2 mm, glabrous. Corolla yellowish white, rotate, fused basal part ca. 0.3 mm; limb 3.5–4.5 mm in diam.; lobes lanceolate, aristate. Anthers very small, ca. 0.3 mm. Mericarp berry black, 3.5–5 mm in diam. Fl. Jun, fr. Jul.

Sandy and salty semideserts. Xinjiang (Yili) [Kazakhstan].

We have seen no authentic material of *Rubia deserticola*. This local C Asiatic semidesert species was regarded as close to the common Mediterranean *R. peregrina* Linnaeus by Pojarkova (loc. cit.) and placed into *R. ser. Peregrinae* Pojarkova of *R. sect. Campylanthera*.

**8. *Rubia dolichophylla*** Schrenk, Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Petersbourg 2: 115. 1844.

长叶茜草 chang ye qian cao

Herbs, perennial, rhizomatous; stems erect, to 1 m tall, glabrous, angled, retrorsely aculeolate. Leaves in whorls of 4,

sessile or subsessile; blade drying papery, linear to lanceolate-oblong, 5–12  $\times$  0.5–1.4 cm, glabrous, abaxially prickly on midrib and often on veins, base acute to cuneate, margins revolute and antrorsely aculeolate, apex acute to acuminate; lateral veins pinnate, 6–10 pairs. Inflorescences thyrsoid, with terminal and axillary, several- to many-flowered cymes, nearly as long as or shorter than subtending leaves; axes aculeolate; bracts linear, 2–5 mm; pedicels 2–6 mm. Ovary 1–1.2 mm in diam. Corolla pale yellow, rotate, fused basal part ca. 0.6 mm; lobes ovate, ca. 2 mm, abruptly contracted with arista ca. 0.5 mm. Mericarp berry black, 2.5–5 mm. Fl. May–Aug, fr. Jul–Sep.

Along rivers and among rocks; 1900–2100 m. Xinjiang [Afghanistan, Kazakhstan, Pakistan, Tajikistan; SW Asia (Iran)].

*Rubia dolichophylla*, well illustrated in H. S. Lo (in FRPS 71(2): 293, t. 62, f. 1–6. 1999), according to Pojarkova (Fl. URSS 23: 404–407. 1958) is one of the two species of *R. ser. Dolichophyllae* Pojarkova, both C Asiatic rhizome-forming herbs. Specimens of *R. jesoensis* (Miquel) Miyabe & Miyaki from Japan with a similar growth form might key out as *R. dolichophylla* but are readily separable by their stems with vegetative apex and exclusively axillary inflorescences with cymes borne along the lower stem portion and usually shorter than the supporting leaves. In *R. dolichophylla* the partial inflorescences are terminal and axillary. As already correctly shown by Pojarkova (loc. cit.), *R. jesoensis* appears related to *R. tatarica* (Treviranus) F. W. Schmidt from SE Russia and adjacent Siberia, and both belong to *R. ser. Tataricae* Pojarkova.

**9. *Rubia edgeworthii*** J. D. Hooker, Fl. Brit. India 3: 203. 1881.

川滇茜草 chuan dian qian cao

Herbs, scandent to climbing; stems 8-ribbed, scabrous. Leaves in whorls of 4, subsessile; blade drying papery, lanceolate to lanceolate-elliptic, 4–7  $\times$  1.2–2 cm, both surfaces scaberulous and sometimes hirtellous, base acute to obtuse, margins entire, apex acute to acuminate; principal veins 3 or 5, palmate. Inflorescences thyrsoid, paniculate, with terminal and axillary, many-flowered cymes, usually much longer than subtending leaves; axes hirtellous, scaberulous to glabrescent; bracts lanceolate or subovate, 2–5 mm; pedicels 2–5 mm. Ovary subglabrous to hirtellous. Corolla pale yellow, somewhat funnel-shaped, glabrous or hirtellous outside, fused basal part ca. 0.5 mm; lobes 5, ovate to lanceolate, 1–1.2 mm, obtuse to acute. Mericarp berry unknown. Fl. Sep.

Grassy slopes; ca. 2100 m. Guangxi (Longlin), Sichuan (Miyi), Yunnan (Heqing) [N India].

We have not seen authentic material of *Rubia edgeworthii*, but both Deb and Malick (Bull. Bot. Surv. India 10(1): 11–12. 1968) and H. S. Lo (in FRPS 71(2): 304, t. 67, f. 8–13. 1999) presented good drawings. Nevertheless, nothing is known about the important underground organs of this species (rootstock or rhizome?). Judging from other characters, *R. edgeworthii* may belong to the vines of the *R. sikimensis* group with *R. tenuis* (see there), but one also has to consider the upright, not climbing members of the *R. mandersii* group; both are elements of *R. sect. Oligoneura*. H. S. Lo (loc. cit.: 308) noted that the unpublished name "*Rubia lancilimba* F. C. How" has been written on specimens of this species.

**10. *Rubia falciformis*** H. S. Lo, J. Trop. Subtrop. Bot. 7(1): 23. 1999.

镰叶茜草 lian ye qian cao

Herbs, perennial, presumably scandent vines; stems quadrangular, scabrous. Leaves opposite; petiole 3–4 cm, rather stout, retrorsely aculeolate; blade drying greenish, thickly leathery, falcate-lanceolate, 11–15 cm, both surfaces scaberulous, usually aculeolate along principal veins, base rounded or subcordate, margin revolute and aculeolate, apex acuminate; principal veins 5, palmate, impressed above, with higher order reticulate veins immersed; stipules caducous, unknown. Inflorescences axillary, with many-flowered cymes. Flowers unknown. Mericarp berries dark orange-yellow when dry, 3.5–4 mm in diam., binary or solitary, densely villous with pubescence drying ferruginous. Fr. Oct.

- Wet lands in forests; ca. 1100 m. Yunnan (Lianghe).

Authentic material of *Rubia falciformis* has not been available, but H. S. Lo (in FRPS 71(2): 295, t. 63, f. 9–11. 1999) presented a good drawing. With the exception of the strongly hairy fruit and the deciduous (and unknown) stipules, its description corresponds to *R. siamensis*, also known from Yunnan, and thus belongs to its group within *R. sect. Oligoneura*.

**11. *Rubia filiformis*** F. C. How ex H. S. Lo, J. Trop. Subtrop. Bot. 7(1): 24. 1999.

丝梗茜草 si geng qian cao

Vines, herbaceous, to 2–3 m tall; stems quadrangular or narrowly 4-winged, glabrous or subglabrous, retrorsely aculeolate on angles. Leaves opposite; petiole (2–)3–15(–25) mm; blade drying thinly leathery or papery, ovate or rarely ovate-lanceolate, 2–9 × 1–4.5 cm, both surfaces glabrous and smooth or sparsely aculeolate along veins, base rounded, subcordate, or obtuse, margins entire and smooth, apex acute to acuminate; principal veins 3 or 5 (or 7), palmate, adaxially impressed; stipules ovate, ca. 5 mm, usually caducous. Inflorescences thyrsoid, paniculiform, with terminal and axillary, many-flowered cymes and slender, subfiliform, smooth and glabrous axes. Flowers unknown. Fruiting pedicels 7–14 mm; mericarp berries black, 4–5 mm in diam. Fr. in late winter.

- Forests; 1000–1500 m. Yunnan (Malipo).

We have seen no authentic specimens of *Rubia filiformis*, but there is a good drawing in H. S. Lo (in FRPS 71(2): 297, t. 64, f. 1–5. 1999). The species evidently belongs to the *R. siamensis* group of *R. sect. Oligoneura*.

**12. *Rubia haematantha*** Airy Shaw, Bull. Misc. Inform. Kew 1931: 450. 1931.

红花茜草 hong hua qian cao

Herbs, perennial, erect to somewhat climbing, with woody rootstock; stems 0.5 m or more, clustered, quadrangular, angles ± retrorsely aculeolate. Leaves in whorls of up to 6–8(–10), narrowly linear, 20–50 × 0.5–1 mm, base acute, margins revolute and retrorsely aculeolate, otherwise glabrous and smooth, single vein forming a thick midrib ca. 1/2 of leaf breadth, apex acute, with hyaline point. Inflorescence thyrsoid, with lax, few-flowered axillary and terminal cymes; bracts filiform; pedicels ca. 5 mm. Ovary ca. 0.5 mm, glabrous. Corolla dark red (perhaps sometimes ?white), rotate, 3–4 mm in diam., glabrous; lobes triangular, 3-veined, abruptly caudate with acumen ca. 1

mm. Mericarp berry black, 3–4 mm in diam. Fl. summer–early autumn, fr. late autumn–early winter.

- Dry and rocky meadows; 3000–3800 m. Sichuan, NW Yunnan.

Together with *Rubia angustissima* Wallich ex G. Don and *R. charifolia* Wallich ex G. Don from the Himalaya, both with greenish-yellowish flowers, the dark-red flowering *R. haematantha* forms an aberrant, closely related species assembly, provisionally called *R. angustissima* group. It occurs from the W Himalaya (Kashmir) to Nepal, Myanmar, Bhutan, and SW China. The group shares retrorsely aculeate stems, linear to filiform leaves in whorls of up to 8(–10), and caudate corolla lobes. Species delimitation within this group is still provisional. Whereas Deb and Malick (Bull. Bot. Surv. India 10(1): 5. 1968) unite *R. angustissima* and *R. charifolia* (“*R. charaefolia*”), the two taxa are maintained by Long (Fl. Bhutan 2(2): 823–825. 1999). The reliability of the flower color as differential character of *R. haematantha* also needs further study. If only one species is accepted, its name would have to be *R. angustissima*.

**13. *Rubia latipetala*** H. S. Lo, J. Trop. Subtrop. Bot. 7(1): 23. 1999.

阔瓣茜草 kuo ban qian cao

Herbs, perennial, with ?rootstock; stems erect, to 20 cm tall, little branched, quadrangular, glabrous, smooth. Leaves in whorls of 4; petiole 0.8–1.8 cm; blade drying greenish, papery, ± broadly ovate, 1.5–3.5 × 1–3 cm, length/breadth index 1.2–1.5, glabrous except hispid on principal veins, base cordulate to cordate, apex acute; principal veins 3–5, palmate. Inflorescences thyrsoid, with terminal and sometimes axillary, 2–5-flowered and 0.5–1 cm long cymes; axes glabrous. Corolla green, turning blackish when dry, bell-shaped, fused part 1.5–2 mm; lobes triangular, ca. 1.5 mm. Mericarp berries unknown. Fl. Aug.

- Forest margins; ca. 3400 m. Sichuan (Barkam).

No authentic material of *Rubia latipetala* was available to us. From the description it belongs to *R. ser. Chinenses*. A completely glabrous and smooth specimen with larger, ovate-cordate leaves (to 5.5 × 3.5 cm) and petioles up to 3.5 cm (1800 m, 21 Jul 1988, PE – sheet no. 1847036) may belong here.

**14. *Rubia linii*** J. M. Chao, Biol. Bull. Natl. Taiwan Norm. Univ. 1: 48. 1966.

林氏茜草 lin shi qian cao

Herbs, climbing or scrambling, to 1.5 m; stems subterete, glabrous, smooth to sparsely aculeolate. Leaves in whorls of 4; petiole 1–4.5 cm, glabrous; blade drying thinly papery, lanceolate, lanceolate-oblong, or oblong-ovate, 2–7.5 × 0.5–3 cm, length/breadth index 2.5–4, glabrous, upper side sparsely scaberulous, base truncate, rounded, or cordulate, margin flat to thinly revolute and smooth, apex acute to acuminate; principal veins 3 (or 5), palmate. Inflorescences thyrsoid, paniculate, with terminal and axillary, several- to many-flowered cymes; axes glabrous and smooth; bracteoles lanceolate to narrowly elliptic, 1–3 mm; pedicels 1–4 mm. Ovary 0.3–0.5 mm, smooth. Corolla white, rotate, ca. 2.5 mm in diam., with lobes usually reflexed, outside glabrous, fused base ca. 0.5 mm; lobes 5, triangular, 1–1.2 mm, acute. Mericarp berry black, 4–7 mm in diam. Fl. May–Aug, fr. Apr, Jul.

- Margins of evergreen forests; 500–3000 m. Taiwan.

*Rubia linii* was accepted in the Fl. Taiwan (ed. 2, 4: 324. 1998), where neither *R. cordifolia* nor *R. wallichiana* figure. In FRPS (71(2): 316. 1999) it was treated in a comment under *R. wallichiana*, as a possible misidentification of that species. *Rubia linii* is an obvious member of the *R. cordifolia* complex (= *R. cordifolia* agg., see additional comments under that species). More detailed studies will have to demonstrate its doubtful specific status; it is obviously very close to *R. cordifolia* and *R. wallichiana*.

**15. *Rubia magna*** P. K. Hsiao, Acta Phytotax. Sin. 23: 390. 1985.

峨眉茜草 e mei qian cao

Vines, herbaceous, to 3 m; stems quadrangular or narrowly 4-winged, sparsely retrorsely aculeolate on angles. Leaves opposite; petiole 1–4(–6) cm, retrorsely aculeolate and sometimes ferruginous hirtellous; blade drying thickly papery to leathery, light green and ± ferruginous, particularly below and on main veins, ovate, lanceolate, or oblanceolate, larger leaves 4–12.5 × 1.5–5(–7) cm, smaller 2–3 × 1–2 cm, glabrous to hirtellous, retrorsely aculeolate at least along veins on both surfaces, base rounded to cordate, margins serrulate-aculeolate, apex acuminate; principal veins 3 or mostly 5; stipules conspicuous, persistent, ± broadly ovate, (5–)10–60 × (4–)8–40 mm, acuminate. Inflorescences predominantly axillary, with several- to many-flowered cymes; axes glabrous to hirtellous, sparsely aculeolate; bracts ovate or sublanceolate, 1–5 mm; pedicels 1–4 mm. Ovary ca. 1 mm, glabrous to glabrescent. Corolla yellow to green, 5-merous, cup-shaped to campanulate, 3.5–4.5 mm in diam., papillose to ± hairy outside; tube 0.8–1.3 mm; lobes triangular-ovate, 1.5–1.7 mm, caudate. Mericarp berry black, 4–5 mm in diam. Fl. Jun–Jul, fr. Aug–Oct.

- Broad-leaved subtropical forests; 1200–1500 m. Sichuan, Yunnan.

The above description of *Rubia magna* combines data from the protologue, H. S. Lo in FRPS (71(2): 295, t. 63, f. 1–8. 1999), and new collections from the Gaoligong Shan region of Yunnan. The latter are conspicuous by their lack of hairiness and their conspicuous stipules (much larger than shown in FRPS). Certain discrepancies (protologue: leaves sometimes sessile and opposite but sometimes petiolate and 3–5-verticillate; H. S. Lo (loc. cit.: 294): corolla lobes 4) may be due to mixed material and still need clarification.

*Rubia magna* is mainly characterized by its opposite leaves, dried green and ferruginous blades, and large stipules. It belongs, together with *R. falciformis* and *R. filiformis*, to the closely related *R. siamensis* group from SW China and adjacent areas.

Originally, *Rubia magna* was described as “a new species of medicinal *Rubia*,” and presumably its uses are detailed in that article.

**16. *Rubia mandersii*** Collett & Hemsley, J. Linn. Soc., Bot. 28: 68. 1890.

黑花茜草 hei hua qian cao

Herbs, perennial, with slightly woody rootstock; stems 20–60 cm tall, erect, unbranched to diffusely branched, quadrangular to narrowly winged, glabrous, ribs retrorsely aculeolate and scabrous to glabrous. Leaves in whorls of 4, sessile; blade drying thickly papery, broadly elliptic-oblong, ovate, or subor-

bicular, 1.5–3.5 × 0.8–1.9 cm, glabrous but scaberulous at least on upper surface, base rounded to cuneate and subpetiolate, margin aculeolate, apex obtuse or acute; principal veins palmate, 3–5. Inflorescences thyrsoid, narrowly paniculate, with terminal and axillary, many-flowered, long-pedunculate cymes; axes glabrous; bracteoles reduced, narrowly ligulate to lanceolate; pedicels 2–4 mm. Ovary ca. 1.5 mm, glabrous. Corolla greenish, yellowish, or whitish, rotate, ca. 5 mm in diam., glabrous, fused basal part 0.5–0.6 mm; lobes lanceolate or ovate, 1.6–2 mm, apex incurved. Immature mericarp berry ca. 3 mm in diam. Fl. Aug, immature fr. Oct.

Dry rocky mountains, *Pinus* forests; 1900–3000 m. Sichuan, Yunnan [Myanmar, Thailand].

*Rubia mandersii*, together with the closely related *R. polyphlebia* and *R. yunnanensis*, forms a SW Chinese group of erect herbaceous perennials with rootstock and ± sessile, lanceolate to broadly ovate, and scabrous or hairy leaves in whorls of 4(–6), which belongs to *R. sect. Oligoneura*.

**17. *Rubia manjith*** Roxburgh ex Fleming, Asiat. Res. 11: 177. 1810.

梵茜草 fan qian cao

*Rubia cordifolia* Linnaeus var. *khasiana* Watt; *R. cordifolia* var. *munjista* (Roxburgh) Miquel; *R. munjista* Roxburgh.

Vines, herbaceous, drying with reddish cast; stems to 3 m, quadrangular, glabrous, retrorsely aculeolate to smooth, with red pith. Leaves in whorls of 4, equal or unequal; petiole 0.8–4 cm, sparsely aculeolate; blade drying papery, mostly greenish adaxially and purplish red abaxially, oblong-lanceolate, ovate-lanceolate, or ovate, (2.5–)4–6(–8.5) × (0.8–)1.8–2.5(–4) cm, length/breadth index 2–3, both surfaces glabrous and scaberulous, base rounded to cordate, margin flat to thinly revolute, aculeolate, apex long acuminate or caudate; principal veins (3 or)5(or 7), palmate. Inflorescences thyrsoid, paniculate, with terminal and axillary, many-flowered and 2.5–10 cm long cymes; axes glabrous and smooth to sparsely aculeolate; bracteoles elliptic-oblong or lanceolate, 0.5–2 mm; pedicels 1.5–3.5 mm. Ovary ca. 0.5 mm, smooth. Corolla red, purplish red, or orange, rotate, glabrous, fused basal part 0.5–0.6 mm; lobes 5, lanceolate to triangular, 1.2–1.5 cm, acuminate. Mericarp berry dark red, 3.5–5 mm in diam. Fl. Jul–Aug, fr. Oct.

Broad-leaved forests, *Pinus* forests and thickets; 700–3600 m. Qinghai, Sichuan, Xizang, Yunnan [Bhutan, India, Nepal].

*Rubia manjith* belongs to *R. ser. Cordifoliae*. Among the taxa with small rotate flowers (*R. cordifolia* agg.) it is mainly characterized by its conspicuous reddish cast, particularly on lower leaf sides and flowers (see additional comments under *R. cordifolia*). A similar cast also appears in the otherwise quite different *R. podantha*, a taxon with campanulate flowers.

Deb and Malick (Bull. Bot. Surv. India 10(1): 6–8. 1968), after a lengthy discussion, treated *Rubia manjith* (“*R. munjista*”) as a synonym of *R. cordifolia* only and identified it with *R. cordifolia* var. *khasiana*. In contrast, Long (Fl. Bhutan 2(2): 823–825. 1999) distinguished *R. manjith* from *R. cordifolia* largely by its red cast, both alive and dried, but agreed with the inclusion of *R. cordifolia* var. *khasiana* as a synonym. The same was maintained by H. S. Lo (in FRPS 71(2): 314. 1999), who added “*R. cordifolia* f. *rubra* Kitamura” as a synonym of *R. manjith* and

qualified it as “nom. non rite publ.” Both Deb and Malick (loc. cit.) and Long (loc. cit.) mention the economic and historical importance of the taxon as a source of an excellent red dye.

**18. *Rubia membranacea*** Diels, Notes Roy. Bot. Gard. Edinburgh 5: 279. 1912.

金钱草 jin qian cao

*Rubia membranacea* var. *caudata* Z. Ying Zhang; *R. membranacea* var. *incurvata* Z. Ying Zhang.

Vines or climbing herbs; stems to 2 m, quadrangular, glabrous or hirtellous at nodes, scaberulous, retrorsely aculeolate, or sometimes subsmooth. Leaves in whorls of 4; petiole 0.5–2.5(–4) cm; blade drying membranous to papery, lanceolate to subovate, 1–6(–8) × 0.5–2(–4) cm, base rounded to cordate, margins usually aculeolate, apex acuminate or shortly acuminate; principal veins 3 or 5, palmate. Inflorescences thyrsoid, paniculate, with terminal and axillary, few- to many-flowered cymes, 2–3 cm; axes glabrous and smooth; pedicels 2–5 mm; bracts narrowly lanceolate, 1–5 mm. Ovary ca. 1.8 mm, glabrous. Corolla purplish red, rotate, fused basal part 0.2–0.6 mm; lobes spreading, ovate-lanceolate, 2–3(–4) mm, caudate. Mericarp berry dark blue or black, 5–9 mm in diam. Fl. May–Jun, fr. Aug–Oct.

• Sparse forests, forest margins, thickets, grasslands; 1100–3000 m. Hubei, Hunan, Sichuan, Yunnan.

We have seen no authentic material of *Rubia membranacea*, which was well illustrated in H. S. Lo (in FRPS 71(2): 293, t. 62, f. 7–12. 1999). The short cymes indicated together with small leaves and relatively large rotate purplish flowers might be distinctive. We have seen only one ± corresponding collection (Sichuan: Mianning Xian, Lamagetou Nature Reserve, *D. E. Boufford et al. 32941*), but it deviates in habit and more loose cymes.

The two varieties of this species listed above were described and figured by Z. Ying Zhang (Fl. Tsinling. 1(5): 17, 421. 1985) but not cited by H. S. Lo (loc. cit.: 314–315). They were distinguished from var. *membranacea* by the orientation of the corolla lobes, said to be “incurved” in var. *incurvata* and long caudate and glabrous in var. *caudata*, differences of doubtful taxonomic relevance.

**19. *Rubia oncotricha*** Handel-Mazzetti, Symb. Sin. 7: 1031. 1936.

钩毛茜草 gou mao qian cao

Herbs, climbing or scrambling; stems 0.5–1.5 m, quadrangular, densely hirtellous or hispidulous with trichomes usually hooked, angles aculeolate. Leaves in whorls of 4; petiole 0.2–1.5 cm, hirtellous; blade drying rather thickly papery, lanceolate to ovate, 0.8–2.5(–3.5) × 0.3–0.8(–1.5) cm, adaxially densely scaberulous and sometimes also hooked hirtellous, abaxially moderately to densely hirtellous, base rounded to usually cordulate, margin thinly revolute and aculeolate, apex obtuse to shortly acute; principal veins 3(or 5), palmate. Inflorescences thyrsoid, paniculate, with terminal and axillary, several- to many-flowered cymes; axes hirtellous or pilosulous, aculeolate; bracteoles lanceolate to narrowly elliptic, 2–5 mm; pedicels 0.5–3(–8) mm. Ovary 0.8–1 mm, smooth. Corolla white or yellow, cup-shaped, outside sparsely to densely hirtellous, fused basal part 0.8–1 mm; lobes triangular-ovate, 1.8–2 mm, cau-

date-acuminate. Mericarp berry 3–3.5 mm in diam., color unknown. Fl. Jul–Sep, fr. Sep–Nov.

• Forest margins, sparse forests, and grasslands on mountain slopes; 500–3200 m. Guangxi, Guizhou, Sichuan, Yunnan.

*Rubia oncotricha*, apparently endemic to SW China, is aberrant by its mostly hooked indumentum (H. S. Lo in FRPS 71(2): 300, t. 65, f. 10–14. 1999). Nevertheless, it clearly belongs to *R. ser. Cordifoliae* (see additional comments under *R. cordifolia*).

**20. *Rubia ovatifolia*** Z. Ying Zhang ex Q. Lin, J. Wuhan Bot. Res. 24: 212. 2006.

卵叶茜草 luan ye qian cao

Vines, herbaceous, perennial, climbing; stems to 1.5 m, slender, quadrangular, glabrous and smooth to sparsely aculeolate. Leaves in whorls of 4; petiole (1.5–)2.5–5.5(–13) cm; blade drying thinly papery, adaxially green, abaxially pale green, ovate-cordiform to suborbicular-cordiform, on lateral branches sometimes ovate, (2–)4–7(–12) × (1–)2–5(–6.5) cm, length/breadth index 1.5–2, glabrous to scaberulous, base cordulate to cordate, margins retrorsely ciliolate or smooth, apex caudate-acuminate, rarely ± obtuse; principal veins 5, palmate. Inflorescence thyrsoid, leafy, with terminal and axillary, few- to many-flowered cymes; axes glabrous and smooth or sparsely aculeolate; bracts linear or lanceolate-linear, 1–3.5 mm; pedicels 1–3 mm. Ovary ca. 1 mm, glabrous. Corolla whitish or pale yellow, subcampanulate, glabrous; tube 0.8–1 mm; lobes spreading and somewhat bent, ovate to lanceolate-triangular, ca. 1.4 mm, caudate. Mericarp berry black at maturity, 4–5 mm in diam. Fl. Jul, fr. Oct–Nov.

• Sparse forests or thickets on mountains; 1700–2200 m. Gansu, Guizhou (Bijie), ?Hubei, Hunan, Shanxi, Sichuan, Yunnan, Zhejiang (Changhua).

This name was first published by Z. Ying Zhang (Fl. Tsinling. 1(5): 15, 420. 1985) but not validly so because two gatherings were designated as types (*Vienna Code*, Art. 37.2). This was corrected in the above citation from 2006.

We have not seen authentic material of *Rubia ovatifolia*, but there are good drawings in the Tsinling flora and in H. S. Lo (in FRPS 71(2): 307, t. 68, f. 1–5. 1999). This and the description show that it belongs to the taxa of *R. ser. Cordifoliae* and the group with campanulate flowers, as *R. alata* or *R. podantha*. This differential character, so far rather neglected, separates these taxa, e.g., from *R. argyi*. Nevertheless, one has to expect intermediates that link *R. ovatifolia* with *R. sylvatica* and *R. cordifolia* s.s. (see the latter for additional comments).

H. S. Lo (loc. cit.: 306) differentiated two varieties of doubtful status: the ranges of petiole length indicated can be found on a single specimen among the principal and the lateral stems; the descriptions do not specify which leaves to measure. The so-called “var. *oligantha*” may be a depauperate or very young specimen of this or some other species. The name was not validly published because no type was indicated and because the name of the species to which it was assigned was not validly published (*Vienna Code*, Art. 37.1 and Art. 43.1, respectively). Without further study it should not be validated.

**21. *Rubia pallida*** Diels, Notes Roy. Bot. Gard. Edinburgh 5: 277. 1912.

浅色茜草 qian se qian cao

Herbs, climbing to scandent; stems to 2 m, quadrangular, glabrous or sometimes pilose, retrorsely aculeolate. Leaves in whorls of 4 (or 6); petiole 0.5–6 cm; blade drying papery, lanceolate or subovate, 0.6–3.5 × 0.3–1.5 cm, length/breadth index ca. 2, subglabrous or adaxially sparsely hirtellous, abaxially scaberulous, base rounded to cordulate, margin densely serrate-aculeolate, apex acuminate; principal veins 3 or 5, palmate. Inflorescences thyrsoid, paniculate, with terminal or axillary, few to several-flowered cymes; axes retrorsely aculeolate; bracts lanceolate, 1–2 mm, subglabrous or hirtellous; pedicels 1–4 mm. Ovary ca. 0.7 mm, smooth. Corolla white or pale yellow, rotate, glabrous or papillose, fused basal part ca. 0.5 mm; lobes spreading, ovate-triangular or lanceolate-triangular, 2–2.5 mm, acuminate. Mericarp berry black, ca. 4 mm in diam. Fl. Jun–Jul, fr. Sep–Oct.

- Thickets, roadsides; 2600–3100 m. NW Yunnan.

*Rubia pallida* belongs to *R. ser. Cordifoliae*. It is obviously close to *R. cordifolia* but deviates by its larger flowers. See further comments under that species.

**22. *Rubia podantha*** Diels, Notes Roy. Bot. Gard. Edinburgh 5: 277. 1912.

柄花茜草 bing hua qian cao

*Rubia nephrophylla* Deb.

Plants herbaceous, perennial, erect or ± climbing, with rootstock and rhizomes; stems to 1.2 m, quadrangular, glabrous to strigose, with retrorsely aculeolate ribs or narrow wings. Leaves in whorls of 4 (or 6), sometimes unequal; petiole 1–5 cm; blade drying papery to subleathery, reddish abaxially or brownish green, lanceolate, lanceolate-ovate, or oblong-ovate, 1.5–5 × 0.5–1.5 cm, length/breadth index 2.5–3.5, both surfaces glabrous, strigillose, or strigose and sparsely to densely scaberulous, base truncate to cordate, margin serrulate-aculeolate or ciliate, apex acute to acuminate; principal veins 3 or 5, palmate. Inflorescences thyrsoid, paniculate, with terminal and axillary, ± many-flowered cymes, axes strigillose to glabrous; aculeolate; bracts lanceolate, 1–5 mm; pedicels 1.5–4 mm. Ovary ca. 0.8 mm, subglabrous. Corolla purplish red or yellowish white, campanulate, glabrous to sparsely hirsutulous; fused part 0.8–1 mm; lobes ovate to lanceolate, 1–1.5 mm, strongly reflexed, caudate to shortly acuminate. Mericarp berry black at maturity, 4–5 mm in diam. Fl. Apr–Jun, fr. Jun–Sep.

- Forest margins, sparse forests, grasslands; 700–3000 m. W Guangxi, W Sichuan, Yunnan.

The type specimens of *Rubia podantha* collected by Forrest from the Lichiang Range, Yunnan, are described in the protologue as semi-scandent, with leaves lanceolate, base cordate, reddish below, and somewhat campanulate purplish flowers. This corresponds well with the figure in H. S. Lo (in FRPS 71(2): 317, t. 71, f. 7–12. 1999) and with a specimen collected from the type locality by Handel-Mazzetti in WU. Thus, *R. podantha* belongs to *R. ser. Cordifoliae* and appears related to other species with campanulate flowers, as *R. alata* or *R. ovatifolia*. It shares the reddish hue with the always scandent *R. manjith*, which has broader leaves and smaller, rotate flowers.

**23. *Rubia polyphlebia*** H. S. Lo, J. Trop. Subtrop. Bot. 7(1): 22. 1999.

多脉茜草 duo mai qian cao

Herbs, perennial, with rootstock; stems erect and rather stout, to 50 cm tall, quadrangular, sulcate, densely shortly hirsute to hispid. Leaves in whorls of 4, sessile; blade drying papery, broadly elliptic-oblong, ovate, or sometimes suborbicular, 2–4.5 × 1–3 cm, both surfaces densely hairy and ± scabrous, base obtuse to subrounded, margins shortly aculeolate-ciliate, apex acute to weakly obtuse; principal veins 7–11, palmate. Inflorescences thyrsoid, paniculate, with terminal and axillary, many-flowered and to 10 cm long cymes; axes shortly hairy, aculeolate to glabrescent; bracts leaflike or lanceolate to linear-lanceolate, 1–2 mm; pedicels ca. 1 mm. Ovary 0.4–0.5 mm, subglabrous. Corolla pale yellow, rotate, 2.5–3 mm in diam., hairy outside, glabrous or scabrous inside, fused basal part 0.2–0.3 mm; lobes ovate or lanceolate, 1–1.2 mm, apex ± recurved. Immature mericarp berry 3–5 mm in diam.

- Sichuan.

*Rubia polyphlebia* belongs to the *R. mandersii* group (see there) of *R. sect. Oligoneura*. We have seen no material of this species, but there is a good drawing in H. S. Lo (in FRPS 71(2): 304, t. 67, f. 1–7. 1999).

**24. *Rubia pseudogalium*** Ehrendorfer, Novon 20: 268. 2010.

高黎贡山茜草 gao li gong shan qian cao

Herbs, perennial, sprawling or twining; stems to 2 m, branched, quadrangular, glabrous and smooth or sparsely retrorsely aculeolate. Leaves and leaflike stipules in whorls of never more than 4; petiole (1–)2–4(–6) mm; blade when drying blackening, subleathery, lower side somewhat brighter than upper, linear-lanceolate, lanceolate, or lanceolate-oblong, often somewhat falcate, 20–40 × 2–8 mm, base cuneate to acute, margins and vein adaxially somewhat retrorsely aculeolate or smooth, apex acute or shortly acuminate; principal vein 1, 2 basal lateral veins very weak, often hardly visible. Inflorescences thyrsoid, with axillary, somewhat narrowly elongate, many-flowered cymes; peduncles glabrous, 3–6 mm; bracts small, linear-lanceolate, 0.5–3 mm; pedicels 1–6 mm. Ovary inferior, obovoid, ca. 0.8 mm. Corolla yellowish green, white, or purple, rotate, fused part 0.2–0.5 mm; lobes 5, ovate-triangular, 1.2–1.5 mm, shortly acuminate. Mericarp berry blackening, globose, 3–5 mm in diam. Fl. May–Jun, fr. Jul–Aug.

- Subtropical montane evergreen broad-leaved forests; 2400–3000 m. Yunnan (Gaoligong Shan region).

This new species is strongly reminiscent of certain taxa of *Galium* in habit. Its technical features (as well as DNA data) clearly place it into *Rubia*. In spite of its narrow leaves with only 2 weak lateral veins, it appears to belong to *R. sect. Oligoneura*. It forms an obviously related group with *R. truppeliana* from the mountains of Shandong. Main differences are the leaf whorls never with more than 4 elements, the shorter leaf petioles and peduncles, and the smaller flowers. There is remarkable variation in leaf shape and flower color, as documented by the numerous specimens available from the Gaoligong Shan region, where *R. pseudogalium* may be endemic.

**25. *Rubia pterygocaulis*** H. S. Lo, J. Trop. Subtrop. Bot. 7(1): 22. 1999.

翅茎茜草 chi jing qian cao

Herbs, perennials, with erect stems tufted from rootstock and from subterranean rhizomes; lower stem portions quadrangular, broadly winged, upper with wings reduced, retrorsely aculeolate. Leaves in whorls of 4–6; petiole 0.5–1 cm; blade drying leathery, ovate, 1–2 × 0.5–1 cm, both surfaces sparsely scaberulous to aculeolate, base cordate, margin revolute and aculeolate, apex cuspidate-acuminate; principal veins 3, palmate, with lateral veins extending for ca. half of blade length. Inflorescences thyrsoid, with terminal and axillary, several-flowered and 1.5–2.5 cm long cymes; axes retrorsely aculeolate with reduced bracts; pedicels filiform, 1–2 mm. Ovary ca. 1 mm, smooth. Corolla dried dark brownish, rotate, ca. 2.5 mm in diam., glabrous; lobes lanceolate-ovate, 1–1.2 mm, cuspidate. Mericarp berry unknown. Fl. Jun.

- Forests, thickets; 300–1000 m. Sichuan (Jiuzhaigou).

No authentic material of *Rubia pterygocaulis* was available, but a good drawing (including underground organs) is found in H. S. Lo (in FRPS 71(2): 300, t. 65, f. 1–9. 1999). The local taxon evidently is a somewhat xerophytic member of *R. ser. Cordifoliae*.

**26. *Rubia reznitzenkoana*** Litvinov, Trudy Bot. Muz. Imp. Akad. Nauk 7: 75. 1910.

小叶茜草 xiao ye qian cao

Subshrubs, with oblique rootstock; stems to 0.5 m, clumped, quadrangular, glabrous, smooth. Leaves in whorls of 4–6 (or 7), subsessile or sessile; blade drying stiffly papery, elliptic-oblong, ligulate, oblanceolate, or lanceolate, 0.5–1.7 × 0.2–0.8 cm, glabrous, smooth, base obtuse to cuneate, margins thickened and aculeolate, apex acute to obtuse with stiff short cusp; principal vein 1. Inflorescences thyrsoid, with terminal and axillary, several- to many-flowered cymes; axes glabrous and smooth; bracts leaflike, 2–5 mm; pedicels ca. 1 mm. Ovary ca. 0.8 mm, smooth. Corolla yellow, funnel-shaped, (2.5–)3–3.5(–4) mm; tube ca. 1.5 mm; lobes often only 4, oblong-lanceolate, ca. 2 mm, obtuse with short incurved cusp. Mericarp berry black-purple when dry, 6–7 mm in diam. Fl. Jun, fr. Aug.

Sandy lands. Xinjiang [Kazakhstan, Mongolia].

*Rubia reznitzenkoana* is a rather isolated C Asiatic psammophyte, for which Pojarkova (Fl. URSS 23: 397. 1958) has created the monotypic *R. sect. Chonanthe*, which we include provisionally into *R. sect. Rubia* (see introduction to *Rubia*).

**27. *Rubia salicifolia*** H. S. Lo, J. Trop. Subtrop. Bot. 7(1): 23. 1999.

柳叶茜草 liu ye qian cao

Vines, herbaceous, or ± climbing herbs; stems to perhaps 1.5 m, quadrangular to 4-ridged, glabrous, ribs aculeolate. Leaves in whorls of 4; petiole 3–12 cm, aculeolate, often pulvinate and strongly bent at base of blade; blade drying papery, grayish brown, linear to narrowly lanceolate, 3–9 × 0.5–1 cm, both surfaces glabrous, smooth or sparsely scaberulous, base obtuse to rounded, margin flat and smooth to denticulate, apex acute to acuminate; principal veins 3, palmate. Inflorescences thyrsoid, paniculate, with terminal and axillary, few- to many-flowered cymes; axes glabrous, aculeolate; bracts linear-lanceolate, 0.5–3 mm; pedicels 3–4 mm. Ovary ca. 0.5 mm, scaberu-

lous. Corolla green, rotate, glabrous; fused basal part ca. 0.5 mm; lobes lanceolate-triangular, ca. 1 mm, cuspidate. Fruit apparently black, 5–6 mm. Fl. Jun–Jul, fr. Sep.

- Moist valleys; ca. 2000 m. Guangdong, Sichuan (Jiulong), ?Yunnan.

This species belongs to *Rubia ser. Cordifoliae* and has been well illustrated in H. S. Lo (in FRPS 71(2): 312, t. 70, f. 7–12. 1999). The above description is based in part on provisionally identified specimens, some of them from Guangdong. Affinities may exist with *R. alata* and its transitional forms with *R. cordifolia* agg. (see additional comments under these species).

**28. *Rubia schugnanica*** B. Fedtschenko ex Pojarkova in Schischkin, Fl. URSS 23: 725. 1958.

四叶茜草 si ye qian cao

Herbs, perennial, or subshrubs, with a rootstock; stems numerous, erect, quadrangular, glabrous, smooth. Leaves in whorls of 4(–6), subsessile or sessile; blade drying subleathery, narrowly lanceolate to linear-lanceolate, 20–50 × 2–5 mm, both surfaces glabrous, smooth, sessile or base narrowed into a very short petiole, margins thickened and retrorsely aculeolate, apex long acuminate; principal vein 1. Inflorescences thyrsoid, with terminal and axillary, several-flowered cymes, shorter than or as long as subtending leaves; peduncles glabrous, 3–10 mm; pedicels 2–5 mm; bracts none or linear, 1–3 mm. Ovary ca. 0.8 mm, smooth. Corolla yellow, rotate; tube 0.2–0.7 mm; lobes lanceolate, 2.3–2.7 mm, acute to mucronate with cusp 0.4–0.6 mm. Mericarp berry black, 3–4 mm in diam. Fl. Jul, fr. Aug.

Sandy lands; ca. 2500 m. Xinjiang [Tajikistan].

We have not seen authentic material of *Rubia schugnanica*. Pojarkova (loc. cit.) placed it into the small C Asiatic and mostly subshrubby *R. ser. Laxiflorae* Pojarkova of *R. sect. Campylanthera*, which we provisionally include in *R. sect. Rubia*.

**29. *Rubia schumanniana*** E. Pritzl, Bot. Jahrb. Syst. 29: 583. 1901.

大叶茜草 da ye qian cao

*Rubia chinensis* Regel & Maack var. *esquirolii* (H. Léveillé) H. Léveillé; *R. cordifolia* Linnaeus var. *maillardii* (H. Léveillé & Vaniot) H. Léveillé; *R. esquirolii* H. Léveillé; *R. leiocaulis* Diels; *R. maillardii* H. Léveillé & Vaniot; *R. schumanniana* var. *maillardii* (H. Léveillé & Vaniot) Handel-Mazzetti.

Herbs, perennial, erect (or rarely ?climbing), with rhizomatous base; stems to 1 m, quadrangular to subterete, sometimes shallowly ribbed and/or sulcate, glabrous or puberulent near nodes, smooth or sometimes sparsely retrorsely aculeolate. Leaves in whorls of 4; petiole equal to unequal, 0.5–1.5(–3) cm; blade drying thickly papery to subleathery, broadly lanceolate, oblong-ovate, or ovate, 3–10 × 1.7–4 cm, length/breadth index 1.5–2.5, glabrous or usually hispidulous along principal veins and scaberulous on lamina, base obtuse to rounded or cordulate, margins thinly revolute and smooth to scaberulous, apex acuminate or subacute; principal veins 3 or 5, palmate, plane to impressed adaxially. Inflorescences thyrsoid-paniculate, cymes 5–12 cm, many flowered, terminal and from uppermost stem

axils; peduncles scaberulous, puberulent, or glabrescent; bracteoles lanceolate, 3–4 mm, ciliate; pedicels 1–6 mm. Ovary ca. 1 mm, glabrous. Corolla white or greenish yellow, somewhat campanulate, 4–5 mm in diam., outside glabrous, inside puberulent to scaberulous, fused base 0.8–1 mm; lobes lanceolate, 2–2.2 mm, acute to acuminate. Mericarp berry black, 5–7 mm in diam. Fl. May–Jul, Nov, fr. Aug–Oct.

- Forests; 800–3000 m. Sichuan, Yunnan.

*Rubia schumanniana* (see H. S. Lo in FRPS 71(2): 301, t. 66, f. 1–7. 1999) belongs to *R. ser. Chinenses*, where it is close to *R. chinensis* and *R. latipetala*, but also to taxa of the *R. mandersii* group with sessile leaves. This plant is described as rarely climbing in H. S. Lo (loc. cit.: 299), but that may be due to misidentified specimens.

**30. *Rubia siamensis*** Craib, Bull. Misc. Inform. Kew 1911: 397. 1911.

对叶茜草 *dui ye qian cao*

Vines, herbaceous, to 3 m; stems quadrangular, glabrous, scaberulous to retrorsely aculeate along angles. Leaves opposite; petiole (1–)2–4(–8) cm, aculeolate; blade drying papery to subleathery, ovate or ovate-lanceolate, 6–12 × (1.5–)3–6(–7.5) cm, glabrous on both surfaces, scaberulous and ± aculeolate on principal veins and margins, base cordate or rounded, apex acute or acuminate; principal veins 3–5(or 7), palmate, reticulate veinlets usually visible on both surfaces; stipules triangular, 3–5(–7) × 2–3 mm, persistent. Inflorescences thyrsoid, paniculiform, with axillary, many-flowered cymes; bracts reduced. Ovary ca. 0.5 mm, glabrous. Corolla greenish, campanulate, ca. 3 mm in diam.; tube ca. 1.25 mm; lobes linear-lanceolate, ca. 2 mm, acute. Fruit of 2 subglobose mericarp berries, 1 sometimes aborted, each 4–5 mm in diam., shiny and black when fresh. Fl. Jun–Jul, fr. Aug–Sep.

Evergreen moist forests; [900–]2200–2500 m. SW Yunnan [N Thailand].

*Rubia siamensis* has been illustrated by H. S. Lo (in FRPS 71(2): 297, t. 64, f. 6–9. 1999) and by Puff (Fl. Thailand: Rubiaceae; [http://homepage.univie.ac.at/christian.puff/FTH-RUB/FTH-RUB\\_HOME.htm](http://homepage.univie.ac.at/christian.puff/FTH-RUB/FTH-RUB_HOME.htm); accessed on 5 Oct 2010) who also gives an extended description. Together with other tropical taxa from SW China and N Thailand (*R. magna*, *R. falciformis*, and *R. filiformis*), all with opposite leaves and true stipules, it forms a well characterized group within *R. sect. Oligoneura*, obviously not closely related to the polymorphic *R. ser. Cordifoliae*. Nevertheless, in the intensively studied Gaoligong Shan region of Yunnan, where *R. siamensis* occurs sporadically, a remarkable series of transitional specimens was documented, linking it with *R. alata*, a member of *R. ser. Cordifoliae* (see under *R. cordifolia*).

**31. *Rubia sylvatica*** (Maximowicz) Nakai, J. Jap. Bot. 13: 783. 1937.

林生茜草 *lin sheng qian cao*

*Rubia cordifolia* Linnaeus var. *sylvatica* Maximowicz, Mém. Acad. Imp. Sci. St.-Petersbourg Divers Savans 9 [Prim. Fl. Amur.]: 140. 1859.

Vines, herbaceous, perennial; stems to 3.5 m, quadrangular, glabrous, aculeolate on ribs. Leaves in whorls of 4–10(–12); petiole 2–11 cm, aculeolate; blade drying thinly membranous or papery, brown-black or blackish green, ovate to suborbicular, 3–11 × 2–9 cm, length/breadth index 1.2–1.5, both surfaces

glabrous, scaberulous on lamina and aculeolate on principal veins, base cordulate to cordate, margins aculeolate, apex acuminate to caudate-cuspidate; principal veins 5 or 7, palmate. Inflorescences thyrsoid, with terminal and axillary, several- to many-flowered cymes; axes slender, glabrous, scaberulous; bracts lacking or linear to lanceolate-linear, 1–5 mm; pedicels 1–7 mm. Ovary ca. 0.8 mm, smooth. Corolla greenish, rotate to slightly patelliform, glabrous, fused basal part 0.4–0.6 mm; lobes triangular, 1–1.5 mm, acuminate. Mericarp berry black, 5–10 mm in diam., with pedicels elongating, to 15 mm. Fl. Jul–Aug, fr. Sep–Oct.

Moist forests or forest margins; 800–3500 m. Throughout N China, also in Sichuan [Russia].

*Rubia sylvatica* belongs to *R. ser. Cordifoliae*. It is apparently connected by transitional specimens with *R. cordifolia* s.s., *R. ovatifolia*, and other closely related species, but quite well separated from the similar *R. argyi*. See these taxa for additional comments and the key for differential characters.

A critical taxon is *Rubia hexaphylla* (Makino) Makino (1927) from Korea and Japan, of which we have not seen authentic specimens. From its description (Yamazaki, Fl. Japan 3a: 232. 1993) one could suspect it to be the same as *R. sylvatica*. If this is proven, the former name has priority. The Kew Rubiaceae checklist (Govaerts et al., World Checkl. Rubiaceae; <http://www.kew.org/wcspr/rubiaceae/>; accessed on 15 Sep 2010) treats *R. sylvatica* as a synonym of *R. cordifolia* subsp. *cordifolia* but maintains *R. hexaphylla*.

**32. *Rubia tenuis*** H. S. Lo, J. Trop. Subtrop. Bot. 7(1): 24. 1999.

纤梗茜草 *xian geng qian cao*

Vines, herbaceous, perennial; stems quadrangular, retrorsely aculeolate on ribs. Leaves in whorls of 4, sessile; blade drying thinly papery, broadly elliptic, 1.5–4 × 0.9–2.3 cm, both surfaces subsmooth or scaberulous to aculeolate on principal veins, base rounded to obtuse, margin sparsely aculeolate, apex cuspidate; principal veins 5, palmate. Inflorescences thyrsoid, with terminal and at lower stem nodes axillary, many-flowered cymes to 14 cm; peduncles slender; bracteoles lanceolate, 2.5–4 mm. Corolla yellow, shallowly campanulate to subrotate, 4–5 mm in diam.; lobes lanceolate, ca. 2 mm, apex incurved, acuminate. Fruit unknown. Fl. Jul.

- Forests, thickets. Sichuan (Luding).

We have not seen authentic material of *Rubia tenuis*, but there is a good drawing in H. S. Lo (in FRPS 71(2): 310, t. 69, f. 1–4. 1999). With respect to habit, indumentum, sessile leaves, inflorescences, and flowers, affinities are suggested with *R. edgeworthii* (see there) and *R. sikkimensis* Kurz. This latter species, well described and figured by Deb and Malick (Bull. Bot. Surv. India 10(1): 12. 1968), is distributed from NE India to Bhutan, but may also reach adjacent China. It mainly differs by larger leaves (5–13 × 2–5 cm) with a rather cuneate base and more acuminate leaf apex. The three species can be assembled provisionally in a *R. sikkimensis* group within *R. sect. Oligoneura*.

**33. *Rubia tibetica*** J. D. Hooker, Fl. Brit. India 3: 204. 1881.

西藏茜草 *xi zang qian cao*

Herbs, perennial, erect, or subshrubs, forming loose cushions from a massive woody rootstock; stems to 0.3 m, quadrangular,

gular, glabrous or mostly with  $\pm$  dense hirtellous indumentum, on angles shortly aculeolate and hispidulous with partly hooked trichomes, lower nodes usually shortly sheathed with membranous bases of old leaves. Leaves opposite and with interpetiolar and  $\pm$  leaflike stipules in whorls of 4(–6), sessile or subsessile; blade drying leathery, broadly to narrowly ovate, elliptic, elliptic-oblong, or lanceolate, 1–3  $\times$  0.3–1.5 cm, both surfaces hirtellous to  $\pm$  glabrous, base acute to obtuse, margins retrorsely aculeolate, toward acute and often cuspidate apex usually antrorsely aculeolate; principal vein 1, sometimes with 2 weak lateral veins. Inflorescences leafy and bracteose, with axillary and terminal, 1- to few-flowered cymes; axes mostly glabrous; pedicels (2–)4–6(–14) mm. Ovary 0.8–1.2 mm, sometimes hirtellous. Corolla yellow, rotate, 5–8 mm in diam., outside sometimes scaberulous; fused base ca. 0.5 mm; lobes lanceolate or lanceolate-ovate, 2–2.5 mm, acuminate. Mericarp berry 3–4 mm in diam. Fl. Jun, fr. Aug.

In gravel at river bottoms; [1700–]3600[–4400] m. Xinjiang, Xizang [Afghanistan, India (Punjab), Kashmir, Kyrgyzstan, Pakistan, Tajikistan].

*Rubia tibetica* is a relatively widespread SW to C Asiatic and typically montane to alpine pioneer species. It was illustrated by Deb and Malick (Bull. Bot. Surv. India 10(1): 4, f. 3. 1968), who lectotypified its name with a specimen from “Tibet” (i.e., Xinjiang). The species is notable for its shoot morphology: the well-developed vegetative leaves of lower stem nodes often appear in a 4-verticillate arrangement with  $\pm$  leaflike stipules, whereas the basalmost first leaves produced by the stems and also the leaves of reproductive nodes are generally paired and exhibit typical interpetiolar stipules.

Deb and Malick (loc. cit.: 4–5) described *Rubia aitchisonii* Deb & Malick from Bagdis, Afghanistan, and separated it by: “Lamina ovate, sub-orbicular, elliptic-ovate or lanceolate, 2–6 in a whorl” in *R. tibetica* vs. “Lamina elliptic-lanceolate, 2 opposite” in *R. aitchisonii*. Ehrendorfer and Schönbeck-Temesy (Fl. Iranica 176: 67. 2005) noted that the only locality of *R. aitchisonii* lies within the area of *R. tibetica* and that the suspected specific differences fall within the morphological variability of *R. tibetica*. Thus, future studies may show that *R. aitchisonii* is better synonymized under *R. tibetica*.

*Rubia tibetica* was placed by Pojarkova (Fl. URSS 23: 401–404. 1958) into *R. ser. Tibeticae* Pojarkova in *R. sect. Campylanthera* together with two other alpine, C Asiatic species: *R. regelii* Pojarkova and *R. komarovii* Pojarkova. They differ from *R. tibetica* by leaves and leaflike stipules in whorls of up to 6 but have not been recorded yet from N China. *Rubia garrettii* Craib from Thailand, also suspected to be a member of this group, certainly does not belong here (see Puff, Fl. Thailand: Rubiaceae; [http://homepage.univie.ac.at/christian.puff/FTH-RUB/FTH-RUB\\_HOME.htm](http://homepage.univie.ac.at/christian.puff/FTH-RUB/FTH-RUB_HOME.htm); accessed on 5 Oct 2010). Whereas the *R. tibetica* group is provisionally included in *R. sect. Rubia*, *R. garrettii* obviously belongs to *R. sect. Oligoneura*.

#### 34. *Rubia tinctorum* Linnaeus, Sp. Pl. 1: 109. 1753.

染色茜草 ran se qian cao

*Rubia iberica* (Fischer ex Candolle) K. Koch; *R. tinctorum* var. *iberica* Fischer ex Candolle.

Herbs, sprawling to climbing, perennial, with extensive stout, woody, and red rhizomes; stems to 1–2.5 m, often fascicled, quadrangular with  $\pm$  sharp angles, somewhat retrorsely aculeolate or glabrous. Leaves in whorls of 4–6, shortly petio-

late to subsessile; blade drying papery to subleathery, lanceolate, lanceolate-oblong, or elliptic-oblong, 3–10  $\times$  0.5–3.5 cm, glabrous or mostly along lower midrib and margins retrorsely aculeolate, base acute, apex acute; lateral veins 3 or 4 pairs, pinnate. Inflorescences thyrsoid, leaflike and many-flowered cymes terminal and axillary from upper stem nodes; axes  $\pm$  retrorsely aculeolate; peduncles up to 50 mm with bracts narrowly elliptic, 2–5 mm; pedicels (0.75–)1.5–8(–12) mm. Ovary ca. 0.8 mm, glabrous. Corolla yellow to greenish yellow, rotate-funnelform, glabrous; tube ca. 1 mm; limb 3–4.5 mm in diam.; lobes lanceolate, ca. 1 mm, shortly acuminate. Anthers large, 0.5–0.6(–0.8) mm, straight. Mericarp berry black, 3.5–4  $\times$  4–4.5 mm. Fl. Jun–Aug, fr. Jul–Sep.

Rather dry open ground; 400–2300 m. Xinjiang [Afghanistan, NW India, Kashmir, Kazakhstan, Pakistan, Turkmenistan; SW Asia (Iran, Turkey); widely cultivated and escaped or weedy from Europe and the Mediterranean throughout the world].

*Rubia tinctorum* is the madder of commerce, cultivated for the dye derived from its rhizomes and roots, and still used in textiles and fine paints. Mainly because of its relatively large and straight anthers, this and a few related taxa from C Asia have been placed into *R. sect. Meganthera* by Pojarkova (Fl. URSS 23: 392–397. 1958). As *R. tinctorum* is the type species of the genus, this section has to be called *R. sect. Rubia* (Ehrendorfer et al., Fl. Iranica 176: 54. 2005).

#### 35. *Rubia trichocarpa* H. S. Lo, J. Trop. Subtrop. Bot. 7(1): 23. 1999.

毛果茜草 mao guo qian cao

Vines, apparently climbing; stems quadrangular, hirsute at least at nodes, retrorsely aculeolate along ribs. Leaves in whorls of 4(–6); petiole slightly shorter than blade, retrorsely aculeate; blade drying thinly papery, grayish green, ovate to cordate, 4–12  $\times$  2.5–7 cm, adaxially glabrous and scaberulous, abaxially sparsely strigillose, hirsutulous, or villosulous, base deeply cordate, margins densely ciliate, apex acuminate; principal veins 3–5, palmate. Inflorescences thyrsoid, paniculate, axillary and perhaps also terminal cymes many flowered and longer than subtending leaves; axes slender, villosulous and retrorsely aculeolate; bracteoles lanceolate, 1.5–2 mm. Flowers not seen. Immature mericarp berry black and shiny when dry, densely ferruginous villous.

• Sichuan (Lixian).

*Rubia trichocarpa* evidently belongs to *R. ser. Cordifoliae*, but no authentic material was available to us. A specimen from Xizang, collected 17 Jul 1973 (PE), fits the above description, with its short hispidulous indumentum extending from stems and leaves to the inflorescence, flowers, and young fruit. It has cymes rather condensed; flowers sessile or on pedicels up to 1.2 mm; and corollas dried purple, ca. 2 mm in diam., campanulate with reflexed petals of ca. 0.8 mm.

#### 36. *Rubia truppeliana* Loesener, Beih. Bot. Centralbl., Abt. 2, 37: 183. 1920.

山东茜草 shan dong qian cao

Herbs, perennial, sprawling or twining, to 2 m; stems branched, quadrangular, glabrous or sparsely puberulent, retrorsely aculeolate on angles, sometimes sulcate-striate. Leaves in whorls of up to 6 or 8; petiole 6–35 mm, aculeolate; blade drying dark green, subleathery, oblanceolate, broadest toward

base, 20–35 × 4–6 mm, scaberulous to retrorsely aculeolate on margins and vein on lower or on both sides, base cuneate to acute, apex acute or shortly acuminate; principal vein 1, 2 lateral veins weaker and hardly reaching half of leaf length. Inflorescences thyrsoid, with terminal and axillary congested to subcapitate cymes; axes aculeolate; bracts lanceolate or linear-lanceolate, 0.5–3 mm; peduncles 10–40 mm; pedicels 0.5–4 mm. Ovary ca. 0.8 mm, smooth. Corolla rotate, glabrous, color not recorded; fused basal part ca. 0.4 mm; lobes ovate-triangular, ca. 2 mm, acuminate. Mericarp berry not seen. Fl. Jul–Aug.

- Forests, thickets; 100–300 m. Shandong.

This local species is certainly close to the newly described *Rubia pseudogalium* from the Gaoligong Shan region of Yunnan but clearly separable (see there). In habit both are quite similar to *Galium*. In spite of their very narrow leaves and only slightly palmate veins, this *R. trupeliana* group probably should be placed into *R. sect. Oligoneura*.

**37. *Rubia wallichiana*** Decaisne, Nouv. Mém. Acad. Roy. Sci. Bruxelles 12: 61. 1837.

多花茜草 duo hua qian cao

Vines or climbing herbaceous perennials; stems to 3 m, 4-angled, glabrous or puberulent at nodes, smooth or sparsely aculeolate. Leaves in whorls of 4(–6); petiole 0.6–6 cm; blade drying thinly papery, lanceolate or ovate-lanceolate, 2–7 × 0.5–2.5 cm, glabrous and sparsely scaberulous, base rounded, truncate, or sometimes cordulate, margins denticulate-aculeolate to smooth, apex acuminate; principal veins 3(or 5), palmate. Inflorescences thyrsoid, paniculate, with terminal and axillary, many-flowered cymes; axes glabrous, smooth to sparsely scaberulous; bracts lanceolate to ligulate, 1–3.5 mm; pedicels 1–4 mm. Ovary ca. 0.5 mm, smooth. Corolla purplish red, greenish yellow, or white, rotate, fused basal part 0.1–0.5 mm; lobes lanceolate to lanceolate-triangular, 1.3–1.5 mm, acuminate, glabrous. Mericarp berry black, 3.5–4 mm in diam. Fl. Aug–Oct, fr. Aug–Dec.

Forests, forest margins, thickets, open fields, village fences; 300–2600 m. Guangdong, Guangxi, Hainan, Hunan, Jiangxi, Sichuan, Yunnan [Bhutan, NE India, Nepal].

The above description and distribution data of *Rubia wallichiana* have been taken over from H. S. Lo (in FRPS 71(2): 315–316. 1999). There are hardly any differential characters relative to *R. cordifolia* s.s. aside from vague references to less prickly stems or differences in flower and fruit color (see key). Thus, this dubious taxon clearly belongs to

*R. ser. Cordifoliae*. Deb and Malick (Bull. Bot. Surv. India 10(1): 1–16. 1968) do not even mention *R. wallichiana*. In Fl. Bhutan (2(2): 823–825. 1999) the name is used in a wide sense and evidently includes what is here treated as *R. cordifolia*, *R. sylvatica*, and possibly even *R. argyi*. The Kew Rubiaceae checklist (Govaerts et al., World Checkl. Rubiaceae; <http://www.kew.org/wcsp/rubiaceae/>; accessed on 15 Sep 2010) accepts *R. wallichiana* as a distinct species. We have hardly seen specimens from China that clearly correspond to *R. wallichiana* (and not to other taxa of *R. cordifolia* agg.). In view of all this, we regard *R. wallichiana* as a possible synonym of *R. cordifolia* s.s. but maintain it as a species in the present flora in order to stimulate its clarification.

**38. *Rubia yunnanensis*** Diels, Notes Roy. Bot. Gard. Edinburgh 5: 278. 1912.

紫参 zi shen

*Rubia ustulata* Diels.

Herbs, perennial, with rootstock and somewhat thickened storage roots; stems usually clumped, suberect, to 0.5 m, quadrangular or narrowly 4-winged, hirsute at nodes to glabrescent, smooth or rarely scabrid. Leaves in whorls of 4(–6), subsessile; blade drying papery, lanceolate, ovate, obovate, elliptic-oblong, broadly elliptic, or suborbicular, 1–4(–5) × 0.3–2 cm, both surfaces hairy to scabrid, base cuneate to rounded, margins flat or often revolute, apex acuminate, shortly cuspidate, or acute; principal veins 3(or 5), palmate. Inflorescences thyrsoid, paniculate, terminal and axillary cymes usually longer than subtending leaves; axes subglabrous to sparsely hirsutulous; bracteoles lanceolate, 2–5 mm; pedicels 1–3 mm. Ovary 0.3–0.4 mm in diam., glabrous. Corolla yellow or pale yellow, rotate, ca. 3 mm in diam., glabrous; fused basal part ca. 0.5 mm; lobes subovate, 1.2–1.5(–2) mm, apex thickened, incurved, shortly rostrate. Mericarp berries not seen.

- Thickets, grassy slopes, roadsides; 1700–3000 m. Sichuan, Yunnan.

In his publication of *Rubia yunnanensis* Diels referred to an unpublished herbarium name “*R. sikkimensis* var. *yunnanensis* Franchet” and commented that “it is quite different from *R. sikkimensis*.” *Rubia ustulata* was published on the same page immediately after *R. yunnanensis* and said to differ by its smaller size, smaller and more equal leaves and leaflike stipules, and more cuspidate petals. In view of the variability of these characters, its synonymization by H. S. Lo (in FRPS 71(2): 303. 1999) is accepted. The species evidently has a considerable altitudinal range and consequently varies from quite elongated to considerably condensed. Within *R. sect. Oligoneura*, *R. yunnanensis* belongs to the *R. mandersii* group of SW China.

## 80. RUBOVIETNAMIA Tirvengadam, Biogeographica (Paris) 74(4): 166. 1998.

越南茜属 yue nan qian shu

Chen Tao (陈涛); Charlotte M. Taylor

Shrubs, unarmed, sometimes with some internodes markedly shortened. Raphides absent. Leaves opposite, sometimes appearing ternate due to reduced internode and marked anisophylly grouping 2 leaves at one node plus an apparently solitary leaf at another node, usually with domatia, at apex sometimes aristate; stipules caducous to late deciduous, shortly united around stem, triangular, inside (i.e., adaxially) pubescent, sometimes aristate. Inflorescences terminal and/or pseudoaxillary, cymose and 2–8-flowered or sometimes reduced to 1 flower, pedunculate, bracteate with bracts often stipuliform. Flowers pedunculate or pedicellate, bisexual, monomorphic. Calyx limb deeply 5-lobed; lobes sometimes imbricate in bud. Corolla white turning yellow with age, salverform to funnellform, inside glabrous except with a pilosulous ring near base; lobes 5, convolute in bud. Stamens 5, inserted near corolla throat, partially exserted; filaments reduced; anthers dorsifixed near base, becoming twisted with age, shortly sagittate at base, with

connective prolonged in an apical triangular appendage. Ovary 1-celled, ovules 2–4 on parietal placentas; stigmas 2, spatulate, partially exerted. Fruit baccate, fleshy to leathery, subglobose, smooth, mature color unknown, with calyx limb tardily deciduous; seeds few to several, medium-sized, ovoid to subglobose, smooth; endosperm abundant; embryo minute, basal, nail-shaped; radicle slightly longer than cotyledons; cotyledons suborbicular.

Two species: China, Vietnam; two species (one endemic) in China.

The protologue figure is labeled "*Vidalasia aristata*," but this species was treated in the text in *Rubovietnamia*; *Vidalasia* Tirvengadam was also described in this same article, and presumably *R. aristata* was to be included in that genus initially. *Vidalasia* has several-flowered compound cymes, erose-setose stipules and bracts, numerous ovules and seeds, and probably may be expected in China also.

- 1a. Leaf blade elliptic or oblanceolate, 4–12 × 1.5–4 cm, adaxially glabrescent to sparsely strigillose, abaxially sparsely strigillose, apex acuminate and aristate; stipules on each side deltoid to ovate, caudate-acuminate; corolla tube cylindrical, lobes glabrous inside, hairy outside; fruit strigillose to glabrescent ..... 1. *R. aristata*  
 1b. Leaf blade obovate, 8–18 × 3–5 cm, densely pubescent on both surfaces, apex acuminate; stipules terminating with reduced interpetiolar limbs; corolla tube funnellform, lobes mostly glabrous inside, pubescent outside; fruit tomentose ..... 2. *R. nonggangensis*

**1. *Rubovietnamia aristata*** Tirvengadam, Biogeographica (Paris) 74(4): 167. 1998.

长管越南茜 chang guan yue nan qian

Shrubs or small trees, to 5 m tall; branches compressed to terete, densely strigillose or hirtellous to glabrous. Leaves in equal to somewhat unequal pairs except in penultimate pair of each stem 1 leaf reduced to a stipulelike scale; petiole 0.4–1 cm, strigillose to glabrescent; blade drying thickly papery, elliptic or oblanceolate, 4–12 × 1.5–4 cm, adaxially glabrescent to sparsely strigillose, abaxially sparsely strigillose throughout, base cuneate and sometimes asymmetrical, apex acuminate and aristate with tip 1–2 mm, formed by prolongation of midrib and inserted 2–3 mm below apex from tip of blade tissue; secondary veins 7 or 8 pairs, with pilosulous domatia in abaxial axils; stipules deciduous throughout or persistent on distalmost several nodes, deltoid to ovate, 5–6 mm, sparsely strigillose, caudate-acuminate, entire to shortly aristate. Inflorescences 1–4-flowered, densely strigillose; bracts triangular to 3-lobed, 3–4 mm; pedicel and/or peduncle 15–25 mm. Calyx densely strigillose to villosulous; ovary portion ellipsoid to obovoid, 4–5 mm; limb lobed essentially to base; lobes ovate to lanceolate, 7–10 × 3–5 mm, often somewhat unequal on an individual flower, ciliolate, aristate. Corolla salverform, outside densely sericeous-strigose; tube 20–25 mm; lobes obovate to oblanceolate, 10–15 × 3–6 mm, acute or shortly acuminate. Anthers ca. 10 mm, with triangular appendage ca. 0.5 mm. Stigmas ca. 5 mm. Berry 1–1.7 cm in diam., strigillose to glabrescent; seeds 5–7 mm. Fl. May–Jul, fr. Jul.

Thickets or forests on limestone hills; 200–1400 m. Guangxi, Yunnan [Vietnam].

**2. *Rubovietnamia nonggangensis*** F. J. Mou & D. X. Zhang, Bot. Stud. (Taipei) 51: 123. 2010.

弄岗越南茜 nong gang yue nan qian

Shrubs or trees, to 3 m tall, without spines; young branches covered with hairs and densely hirsute under stipules. Petiole 0.5–1 cm; leaves thickly papery, obovate, 8–18 × 3–5 cm, densely pubescent on both surfaces, base cuneate, apex acuminate; main and lateral nerves visible adaxially, very prominent abaxially, secondary veins 7–14 pairs; stipules ca. 5 mm, papery, outside coated with thick hairs, terminating with 2 minute interpetiolar limbs. Inflorescences 2–8-flowered cymes, superaxillary on lateral branches, with both bracts and bracteoles triangular, 3–4 mm; pedicels to 25 mm in open flowers. Flowers 5-merous, very fragrant. Calyx tube campanulate, to 8 mm, hispid, widening at apex with enlarged (well-developed) lobes; lobes elliptic-lanceolate, to 10 × 5 mm, imbricate, markedly veined, coated with dense hairs, apiculate, deciduous. Corolla tubular, glossy, fleshy, waxy, cream white at anthesis, turning yellow with age and without spots in tube; tube dilating gradually to throat, to 35 mm, very narrowly tubular in lower part and convex in middle, ca. 5 mm wide at middle, outside hairy, inside largely glabrous except for a zone 1–1.5 cm above base covered with hairs; lobes obovate to lanceolate, to 18 × 5.5 mm, contorted to left in bud stage, pubescent outside, mostly glabrous inside, reflexed at anthesis. Stamens 5, inserted just at corolla throat and between corolla lobes, sessile; anthers linear, to 5 mm, adnate, 1/2 of length exerted ± medifixed, exerted after anthesis. Ovary inferior, with 2 parietal placentas, numerous ovules each in 2 rows on an oblong-elliptic placenta fusing to form a compact mass when mature; style 3.5–4 cm, with glabrous columnar basal part and pubescent at 2 cm above base; stigma ca. 4.5 × 3 mm, with 2 lobes initially cohering together, fluted, wholly exerted. Floral disk annular. Berry to 2 × 1.5 cm, tomentose, crowned by remnants of calyx and a large yellow disk, lacking ribs; petiole to 2.5 cm; seeds to 6.

● Rocky crevices in moist forests of limestone areas; 200–400 m. SW Guangxi [Vietnam].

## 81. *SAPROSMA* Blume, Bijdr. 956. 1826–1827.

染木树属 ran mu shu shu

Chen Tao (陈涛); Charlotte M. Taylor

Erect shrubs, unarmed, usually fetid when bruised. Raphides present. Leaves opposite or in whorls of 3 or 4, sometimes with domatia; stipules caducous or persistent, interpetiolar, triangular, entire or 1–3-setose or multifid. Inflorescences axillary or terminal,

fasciculate or cymose and several flowered or reduced to 1 flower, pedunculate to sessile, bracteate with bracts usually fused in pairs. Flowers sessile or pedicellate, bisexual, apparently monomorphic. Calyx limb 4–6-lobed, sometimes funnellform, lobes sometimes unequal. Corolla white, campanulate, tubular, or funnellform, inside villous in throat; lobes 4(–6), valvate-induplicate in bud, with margins sometimes crisped. Stamens 4(–6), inserted in corolla throat, usually partially exerted; filaments short or reduced; anthers dorsifixed near base. Ovary 2-celled, ovules 1 in each cell, basal, erect; style 2-lobed, included or exerted. Fruit blue or purplish black, drupaceous, fleshy, ellipsoid, with calyx limb persistent; pyrenes 1 or 2, 1-celled, with 1 seed, crustaceous to papery; seeds medium-sized, plano-convex, subobovoid, or ellipsoid, abaxially (i.e., dorsally) smooth to verrucose, endosperm fleshy; cotyledon tiny, leaflike; radicle slender, close to hilum.

About 30 species: tropical Asia; five species (four endemic) in China.

*Saprosma* is not well known. Analyses of relationships among *Lasianthus* and related genera support the transfer of *S. crassipes* into that genus, although the authors did not publish a formal nomenclatural transfer (Xiao & Zhu, Bot. Stud. (Taipei) 48: 227–232. 2007).

- 1a. Flowers sessile in sessile glomerules or heads.  
 2a. Flowers mostly in terminal heads, sometimes also borne in uppermost leaf axils; petioles 1–3 mm ..... 2. *S. hainanensis*  
 2b. Flowers in glomerules borne along much of length of stem, sometimes also in a terminal head; petioles 10–12 mm ..... 4. *S. merrillii*  
 1b. Flowers sessile to pedicellate in pedunculate and/or branched inflorescences.  
 3a. Flowers on pedicels 2–10 mm, in branched cymes borne on peduncles 10–40 mm; leaves opposite or more often ternate; pyrenes smooth abaxially ..... 5. *S. ternata*  
 3b. Flowers sessile in heads, borne on peduncles 5–20 mm; leaves opposite; pyrenes verrucose abaxially.  
 4a. Peduncles 5–8 mm; secondary leaf veins 7–10 pairs; corolla tube 7–8 mm ..... 1. *S. crassipes*  
 4b. Peduncles 10–20 mm; secondary leaf veins 4–6 pairs; corolla tube ca. 10 mm ..... 3. *S. henryi*

**1. *Saprosma crassipes*** H. S. Lo, Bot. J. S. China 2: 15. 1993.

厚梗染木树 hou geng ran mu shu

Shrubs 1–2 m tall or occasionally small trees to 5 m tall; branches weakly flattened to subterete, glabrous. Leaves opposite; petiole 3–10 mm, glabrous to sparsely strigillose; blade drying thinly leathery, dark to pale green, elliptic-ovate or oblong-ovate, 8–16 × ca. 6 cm, both surfaces glabrous, base obtuse or rounded, apex abruptly acuminate; secondary veins 7–10 pairs, joining in a submarginal vein, without domatia; stipules caducous, triangular, ca. 1.5 mm, strigillose to glabrous, acute. Inflorescences axillary and sometimes also terminal, capitate, several flowered, strigillose to glabrous; peduncle compressed, 5–8 mm; bracts ovate, 1–2 mm; pedicels to 2 mm. Flowers subsessile to pedicellate. Calyx with hypanthium portion cupuliform, ca. 1 mm, glabrous; limb 0.8–1 mm, shallowly lobed, strigillose to glabrous; lobes broadly triangular, ciliate. Corolla tubular-funnelform, glabrous outside, villous inside; tube 7–8 mm; lobes broadly ovate, ca. 2 mm. Drupes ellipsoid, 7–8 mm; pyrenes hemispherical, verrucose abaxially. Fl. May, fr. May–Oct.

• Forest margins; 300–1300 m. Hainan, Yunnan (Xishuangbanna) [?Vietnam].

A recent analysis of molecular data suggested that this species may be better placed in *Lasianthus*, though the authors did not make a formal nomenclatural transfer (Xiao & Zhu, Bot. Stud. (Taipei) 48: 227–232. 2007).

**2. *Saprosma hainanensis*** Merrill, Lingnan Sci. J. 9: 44. 1930 [*“hainanense”*].

海南染木树 hai nan ran mu shu

Erect shrubs, 1–2 m tall; branches weakly flattened to terete, glabrous, with epidermis often becoming hardened then fragmenting. Leaves opposite or sometimes appearing whorled due to congested nodes with internodes not expanded, sometimes in unequal pairs; petiole 1–3 mm, glabrous; blade drying

membranous to papery, oblong-ovate to oblong-elliptic, 3.5–15 × 1.5–5.5 cm, adaxially glabrous, abaxially glabrous or hirtellous on principal veins, base rounded to cuneate, apex acute or shortly acuminate; secondary veins 7–12 pairs, usually joining in a submarginal vein, usually with pilosulous or foveolate domatia; stipules caducous, ovate, 2–3 mm, glabrous, aristate with bristle 1–3 mm. Inflorescences terminal and in uppermost leaf axils, glomerulate or capitate, few flowered, glabrous; bracts ovate, usually fused in pairs, 1–2 mm. Flowers sessile. Calyx glabrous; hypanthium portion obconic, 1–2 mm; limb 1–2 mm, lobed for ca. 1/2; lobes 4(–6), triangular. Corolla tubular, glabrous or puberulent outside; tube ca. 3 mm, in throat villous; lobes 4, elliptic to elliptic-ovate, ca. 2.5 mm. Drupes obovoid, 6–7 × 3–4 mm; pyrenes plano-convex, smooth abaxially. Fl. Jun, fr. Oct–Nov.

• Ravines; 300–1700 m. Hainan.

H. S. Lo (in FRPS 71(2): 67. 1999) described the calyx lobes as 5 or 6, but they are consistently 4 on the specimens studied.

**3. *Saprosma henryi*** Hutchinson in Sargent, Pl. Wilson. 3: 417. 1916.

云南染木树 yun nan ran mu shu

Shrubs, ca. 3 m tall; branches glabrous. Leaves opposite; petiole 3–7 mm, glabrous; blade drying thinly papery, elliptic or oblong-elliptic, 6–9 × 3–5 cm, both surfaces glabrous, base obtuse, apex shortly acuminate; secondary veins 4–6 pairs, joining in a submarginal vein; stipules triangular, 1.5–2 mm. Inflorescence capitate, few flowered; peduncle 10–20 mm, longitudinally ridged. Flowers sessile. Calyx with hypanthium portion glabrous; lobes triangular, ca. 1.25 mm, subglabrous. Corolla tubular-funnelform, glabrous outside; tube ca. 10 mm, pilose inside; lobes ovate-triangular, ca. 2 mm, obtuse. Drupes obovate, ca. 8 mm; pyrenes verrucose abaxially.

• Mountain forests; 1300–1700 m. Yunnan.

**4. *Saprosma merrillii*** H. S. Lo, Bot. J. S. China 2: 15. 1993.

琼岛染木树 qiong dao ran mu shu

*Lasianthus hainanensis* Merrill, Philipp. J. Sci. 21: 355. 1922, not *Saprosma hainanensis* Merrill (1930).

Shrubs, 2–3 m tall; branchlets terete, strigose or hirtellous to glabrous. Leaves opposite; petiole 10–12 mm, hirtellous or strigillose; blade drying stiffly papery, elliptic-oblong to lanceolate, 10–17 × 3.5–6 cm, adaxially glabrous, abaxially glabrous or usually hirtellous along midrib, base cuneate to truncate, apex acuminate; secondary veins 14 or 15 pairs, joining in a submarginal vein, without domatia; stipules persistent, narrowly triangular, 2–3 mm, strigillose or hirtellous to glabrescent, acute. Inflorescences axillary along stem and sometimes also terminal, glomerulate or capitate, sessile, several flowered, strigillose or hirtellous; bracts apparently reduced. Flowers sessile. Calyx with hypanthium portion obconic, ca. 1 mm, pilosulous to glabrous; limb ca. 1 mm, deeply lobed; lobes triangular. Corolla tubular-funnelform, glabrous outside, villous in throat and on lobes inside; tube 4–4.5 mm; lobes ovate, ca. 1.5 mm. Drupes obovate to oblong-obovate, 7–8(–12) mm; pyrenes plano-convex, smooth abaxially. Fl. Apr.

- Sparse forests or forest margins; 300–1000 m. Hainan.

**5. *Saprosma ternata*** (Wallich) J. D. Hooker, Fl. Brit. India 3: 193. 1881 [*“ternatum”*].

染木树 ran mu shu

*Paederia ternata* Wallich in Roxburgh, Fl. Ind. 2: 520. 1824; *Serissa ternata* (Wallich) Kurz.

Erect shrubs 1–4 m tall, or sometimes small trees 5–6 m tall; branches angled, glabrous. Leaves in whorls of 3 or sometimes opposite; petiole 6–12 mm, glabrous; blade drying thinly leathery to papery, elliptic, oblong-lanceolate, or oblong-elliptic, 8–15 × 3–6.5 cm, both surfaces glabrous, base acute to obtuse, apex shortly acuminate; secondary veins 7–10 pairs, not joining in a submarginal vein, without domatia; stipules caducous, narrowly triangular to lanceolate, 5–12 mm, with 2–7 linear teeth or projections. Inflorescences axillary, cymose, glabrous; peduncles 1–3 per axil, 10–40 mm; bracts triangular to ovate, 1–5 mm, often aristate, usually deciduous after flowering; pedicels 2–10 mm. Flowers pedicellate. Calyx glabrous; hypanthium portion cupuliform, 2–2.5 mm, glabrous; limb 1–2 mm, shallowly and sometimes irregularly lobed; lobes triangular. Corolla tubular, puberulent to tomentulose outside; tube 3–8 mm, pilose in throat; lobes triangular usually with expanded crisped margins, 3–4 mm. Drupes ellipsoid or subglobose, 8–12 × 6–8 mm; pyrenes plano-convex, smooth abaxially. Fl. Apr, Jun, fr. Sep–Nov.

Sparse forests at low to middle elevations, forests in ravines; 400–1000 m. Hainan, Yunnan [NE India, Malaysia].

**82. SCHIZOMUSSAENDA** H. L. Li, J. Arnold Arbor. 24: 99. 1943.

裂果金花属 lie guo jin hua shu

Chen Tao (陈涛); Charlotte M. Taylor

Shrubs to small trees, unarmed. Raphides presumably absent. Leaves opposite, apparently without domatia or these infrequent and rudimentary; stipules persistent at least near stem apex, interpetiolar, generally triangular, 2-lobed. Inflorescences terminal and sometimes also in uppermost leaf axils and appearing sessile and tripartite, cymose with higher order axes often scorpioid, many flowered, pedunculate, bracteate with bracts persistent or caducous. Flowers sessile or subsessile, bisexual, distylous. Calyx limb deeply 5-lobed, on 1 or several flowers of an inflorescence with 1 white, elliptic or ovate calycophyll. Corolla orange-yellow to orange, salverform with tube slender then abruptly swollen in upper part, inside pubescent at least in throat; lobes 5, notably acuminate, in bud valvate-induplicate with tips pressed together and ascending. Stamens 5, inserted in upper part of corolla tube, included in long-styled form, partially exerted in short-styled form; filaments short; anthers apparently basifixed. Ovary 2-celled, ovules numerous in each cell on axile peltate placentas; stigmas 2, linear, exerted in long-styled form or included in short-styled form. Fruit capsular, ellipsoid to obovoid, slightly flattened perpendicular to septum, loculicidally dehiscent through apical half, woody, with calyx limb persistent, with calycophylls persistent; seeds numerous, small, angled.

One species: SW China, Laos, N Myanmar, N Thailand, N Vietnam.

This species was long included in *Mussaenda*, but morphological and molecular studies support its separation from that genus. Its morphology was studied by Puff et al. (Bull. Jard. Bot. Natl. Belg. 62: 35–68. 1993). Its lack of raphides has not been described but is presumed based on the classification of this genus by various authors in Isertiaeae.

**1. *Schizomussaenda dehiscens*** (Craib) H. L. Li, J. Arnold Arbor. 24: 100. 1943.

裂果金花 lie guo jin hua

*Mussaenda dehiscens* Craib, Bull. Misc. Inform. Kew 1916: 263. 1916; *Emmenopterys rehderi* F. P. Metcalf; *M. elongata* Hutchinson; *M. henryi* Hutchinson; *Schizophragma macrosepalum* Hu.

Shrubs to small trees, to 8 m tall; branches flattened or angled to terete, strigose to strigillose becoming glabrescent

with age, often with sparse to rather dense ellipsoid lenticels. Petiole 0.5–1.6 cm, strigose to strigillose; leaf blade drying thinly papery, lanceolate, lanceolate-elliptic, or ovate-lanceolate, 10–17 × 2.5–6 cm, adaxially sparsely hirsute or strigose at least along principal veins to glabrescent, abaxially strigose to strigillose along principal lateral veins, sparsely strigose along higher order veins, and glabrescent on blade, base cuneate to rounded, apex acuminate or acute; secondary veins 7–10 pairs, infrequently with a few pilosulous domatia; stipules 5–14 mm, abaxially strigose to strigillose, 2-lobed for 1/4 to nearly completely. Inflorescences densely hirtellous to strigillose; peduncle

2.5–9 cm; branched portion 7–18 × 7–17 cm; bracts 3–15 mm, acute to acuminate. Calyx puberulent; ovary portion obovoid to ellipsoid, 1.5–2 mm; lobes narrowly triangular, 1–2 mm, acute; calycophyll puberulent to strigillose at least on veins and margins, blade drying papery, ovate to broadly ovate, 3–10 × 3–6 cm, 5-veined from near base, base cuneate or acuminate, apex acute or obtuse, with stipe 2–3 cm. Corolla strigose to strigillose outside; tube 18–22 mm, inside densely sulfur-yellow pi-

lose in throat and similarly but more sparsely pubescent near base; lobes broadly ovate, 2.5–3 mm, acuminate to aristate with tip or arista 0.5–1 mm. Anthers ca. 3 mm. Capsule 6–8 × 4.5–5 mm; seeds 0.1–0.2 mm, minutely foveolate and sulcate. Fl. May–Oct, fr. Jul–Dec.

Forests; 100–1000 m. Guangxi, Yunnan [Laos, N Myanmar, N Thailand, N Vietnam].

### 83. SCYPHIPHORA C. F. Gaertner, Suppl. Carp. 91. 1806.

瓶花木属 ping hua mu shu

Chen Tao (陈涛); Charlotte M. Taylor

Shrubs or small trees, unarmed, rather succulent, sometimes with stilt roots; young growth usually mucilaginous or resinous. Raphides presumably absent. Leaves opposite, decussate, without domatia, notably leathery, with petioles articulate; stipules persistent, united around stem, rounded to truncate, entire, enclosing well-developed colleters. Inflorescence axillary, congested-cymose with axes often articulate and regularly dichotomous, pedunculate, bracteate with bracts small and fused in pairs, apparently caducous. Flowers sessile or pedicellate, bisexual, monomorphic. Calyx limb cupuliform, subtruncate or (4 or)5-denticulate. Corolla white or pink, salverform with tube somewhat expanded in throat, pubescent inside; lobes (4 or)5, convolute in bud. Stamens (4 or)5, inserted in corolla just below throat, partially to fully exerted; filaments short; anthers dorsifixed, bifid at base. Ovary 2-celled, ovules 2 in each cell, axile and attached in middle of septum with 1 erect and 1 pendulous; stigmas 2, exerted. Fruit drupaceous (or indehiscent depending on interpretation), ellipsoid-oblong to ellipsoid, often weakly curved, fleshy becoming corky, (6–)8-ridged or -winged, with calyx limb persistent; pyrene 1, 2-celled, with 2 seeds in each cell, ellipsoid and longitudinally ridged or winged; seeds medium-sized, subcylindrical; testa membranous; endosperm reduced; cotyledons oblong; radicle long.

One species: coastal China, Madagascar, Philippines, Thailand, Vietnam, and Pacific region east to Caroline Islands, New Caledonia, and Australia.

This unusual species was studied in some detail by Puff and Rohrhofer (Opera Bot. Belg. 6: 143–172. 1993), who reported that the flowers have an “ixoroid” pollination mechanism, in which the flowers are protandrous and deposit the pollen on the outside of the stigmas and the style for dispersal. The presence or absence of raphides seems not to have been specifically noted; their absence is presumed here based on the classification by many authors of this genus in Gardenieae.

W. C. Chen (in FRPS 71(1): 368. 1999) described the funiculi of the ovules as connate, but this condition has not been otherwise reported and contradicts the work of Puff and Rohrhofer (loc. cit.).

**1. *Scyphiphora hydrophyllacea*** C. F. Gaertner, Suppl. Carp. 91. 1806.

瓶花木 ping hua mu

Shrubs or small trees, 1–4(–6) m tall, turning black or dark brown when dry; branches weakly flattened to angled or terete, glabrous to puberulent, with nodes sometimes thickened, sometimes with reduced internodes and congested nodes. Petiole 0.5–1.5 cm, glabrous; leaf blade drying leathery, obovate to broadly elliptic, 2.5–7.5 × 1.5–4.5 cm, glabrous on both surfaces, adaxially usually shiny, base cuneate to obtuse, apex

rounded; secondary veins not visible or 4–6 pairs; stipules 1.5–3 mm, margins often sparsely to densely ciliate. Inflorescence 1.5–3 × 2–2.5 cm; peduncle 0.5–1 cm. Flowers sessile or pedicellate, pedicels or subtending inflorescence axes to 2 mm. Calyx glabrous to puberulent; ovary portion cylindrical-ellipsoid, 3–4 mm; limb 1–1.5 mm, truncate to denticulate. Corolla glabrous outside; tube 4–5 mm; lobes ovate-ligulate, ca. 2 mm, obtuse. Drupe 8–11 × 3–5 mm, glabrous. Fl. Jul–Nov, fr. Aug–Dec.

Foreshore mud at seashores; near sea level. Hainan [Philippines, Thailand, Vietnam; SE Asia to Pacific islands, Australia, Madagascar].

### 84. SERISSA Commerson ex Jussieu, Gen. Pl. 209. 1789.

白马骨属 bai ma gu shu

Chen Tao (陈涛); Charlotte M. Taylor

Small shrubs, usually much branched, unarmed, fetid when bruised, usually with short shoots. Raphides present. Leaves opposite but often crowded and apparently verticillate, decussate, without domatia; stipules persistent, interpetiolar and often fused to petioles, generally triangular to truncate, with 1–8 bristles. Inflorescences terminal on principal stems and/or terminal on axillary short shoots and apparently axillary, capitate and several flowered or reduced to 1 flower, sessile, bracteate. Flowers sessile or subsessile, bisexual, distylous. Calyx limb 4–6-lobed essentially to base. Corolla white to pink, funnelform or tubular-funnelform, inside villous in tube; lobes 4–6, valvate-induplicate in bud, with margins sometimes crisped. Stamens 4–6, inserted in upper part of corolla tube, included or exerted; filaments short to developed, anthers dorsifixed near base. Ovary 2-celled, ovules 1 in each cell, erect,

basal; stigma 2-lobed, included or exerted. Fruit drupaceous or tardily capsular, obconic to obovoid, leathery to apparently dry, tardily dehiscent septically then loculicidally across top, with calyx limb persistent and often enlarging and becoming spiny; pyrenes 2, 1-celled, each with 1 seed, oblong to obovoid, longitudinally densely ridged.

One or two species: China, Japan, Nepal, Vietnam; one or two species (one endemic) in China.

Puff et al. (Rubiaceae of Thailand, 232. 2005) reported that the fruit of *Serissa* are dehiscent through an apical operculum, releasing two 1-seeded pyrenes; the fruit of the Chinese specimens studied appear to split across the top and partly down the sides to release the obovoid striate pyrenes through the top or disk portion (i.e., the apical section inside the calyx limb), which may correspond to the dehiscence described by Puff et al. The leaf and flower size and pubescence appear to be widely variable, which probably has fueled the selection that has produced a wide range of cultivated forms. *Serissa* is widely cultivated in tropical and warm temperate regions for its foliage, both variegated and solid, and showy flowers, including frequently as bonsai plants. Normally the cultivated plants in regions outside the native range do not produce fruit. Puff et al. (loc. cit.) discussed and illustrated some of the numerous cultivated forms, which go under the English name "snowrose."

The number of species of *Serissa* is controversial. W. C. Ko (in FRPS 71(2): 159–162. 1999) and Puff et al. (loc. cit.) recognized two species, others (Govaerts et al., World Checkl. Rubiaceae; <http://www.kew.org/wcsp/rubiaceae/>; accessed on 20 Aug 2007; D. Lorence, Fl. Mesoamericana, in prep.) recognize only one species. In general, more robust plants have been included in *S. serissoides*. W. C. Ko's treatment is presented here for reference, with the description of *S. japonica* augmented with characters from specimens; however, some specimens are not conclusively assignable to one of these species.

- 1a. Leaf blade drying stiffly papery to leathery, ovate to oblanceolate, elliptic, elliptic-oblong, or lanceolate, 0.6–2.2 × 0.3–0.6 mm, apex acute to obtuse or acuminate; flowers solitary to several; corolla tube longer than calyx lobes ..... 1. *S. japonica*  
 1b. Leaf blade drying thinly papery, obovate or oblanceolate, 1.5–4 × 0.7–1.3 cm, apex acute or subacute; flowers solitary or usually several; corolla tube as long as calyx lobes ..... 2. *S. serissoides*

**1. *Serissa japonica*** (Thunberg) Thunberg, Nov. Gen. Pl. 132. 1798.

六月雪 liu yue xue

*Lycium japonicum* Thunberg, Nova Acta Regiae Soc. Sci. Upsal. 3: 207. 1780; *L. foetidum* Linnaeus f.; *Serissa foetida* (Linnaeus f.) Lamarck.

Small shrubs, 60–90 cm tall, presumably evergreen; branches weakly flattened to terete, puberulent to villosulous or hirtellous in interpetiolar lines to sometimes uniformly puberulent throughout. Leaves subsessile or with petiole to 2 mm, glabrous or puberulent to villosulous; blade drying leathery to stiffly papery, ovate to oblanceolate, elliptic, elliptic-oblong, or lanceolate, 0.6–2.2 × 0.3–0.6 cm, both surfaces glabrous to hispidulous or villosulous on principal veins to throughout, often shiny adaxially, base obtuse to acute, apex acute to obtuse or acuminate; secondary veins 2–4 pairs; stipules 0.5–2 mm, puberulent to villosulous, truncate to triangular, with bristles 0.5–4 mm. Flowers solitary to several; bracts narrowly triangular to spatulate, 1–6 mm, glabrous to villosulous, acute, margins entire to ciliate or hispidulous. Calyx glabrous to puberulent or hirtellous; ovary portion obconic, 1–1.5 mm; limb lobed essentially to base; lobes narrowly triangular to lanceolate or linear, 1–5 mm, entire to ciliolate or hispid. Corolla outside glabrous to puberulent or villosulous; tube 4–8 mm; lobes narrowly triangular to ovate, 2–2.5 mm. Drupes 2–3 mm; pyrenes 2–2.5 mm. Fl. Apr–Oct, fr. Jun–Nov.

• Streamsides or broad-leaved forests on hills; 100–1600 m. Anhui, Fujian, Guangdong, Guangxi, Jiangsu, Jiangxi, Sichuan, Taiwan, Yunnan, Zhejiang [widely cultivated elsewhere].

The Fl. Taiwan (ed. 2, 4: 324–325. 1998) treated one species of *Serissa*, which was called *S. serissoides* but which keys out to *S. japonica* in the classification of W. C. Ko (in FRPS 71(2): 160. 1999); that report is accordingly listed here based on this re-identification.

**2. *Serissa serissoides*** (Candolle) Druce, Rep. Bot. Soc. Exch. Club Brit. Isles 1916: 646. 1917.

白马骨 bai ma gu

*Democritea serissoides* Candolle, Prodr. 4: 540. 1830; *Leptodermis nervosa* Hutchinson; *Serissa democritea* Baillon, nom. illeg. superfl.

Small shrubs, to 1 m tall; branches stout, subterete, gray, pilosulous to glabrescent or puberulent. Leaves usually in clusters, subsessile; blade drying thinly papery, obovate or oblanceolate, 1.5–4 × 0.7–1.3 cm, glabrous except sparsely pubescent abaxially, base acute, apex acute or subacute; secondary veins 2 or 3 pairs; stipules with lobes subulate, ca. 2 mm, broad at base, sparsely pubescent. Flowers solitary to usually several; bracts membranous, elliptic, ca. 6 mm, long acuminate, sparsely ciliolate. Calyx glabrescent; ovary portion obconic, ca. 1 mm; limb lobed essentially to base; lobes 5, lanceolate-subulate, ca. 4 mm, sharply acute, ciliate. Corolla outside glabrous; tube ca. 4 mm; lobes 5, oblong-lanceolate, ca. 2.5 mm. Fruit not seen. Fl. Apr–Jun.

Wastelands, lawns. Anhui, Fujian, Guangdong, Guangxi, Hubei, Jiangsu, Jiangxi, Taiwan, Zhejiang [Japan].

W. C. Ko (in FRPS 71(2): 162. 1999) reported this species also from Japan, but the Fl. Japan (3a: 228–229. 1993) did not recognize it.

## 85. SINOADINA Ridsdale, Blumea 24: 351. 1979.

鸡仔木属 ji zai mu shu

Chen Tao (陈涛); Charlotte M. Taylor

Trees, unarmed; buds rounded. Raphides absent. Leaves opposite, decussate, usually with domatia; stipules caducous, interpeti-

olar, broadly triangular in outline, deeply bifid. Inflorescences terminal and in axils of uppermost leaves, capitate with 7–11 globose heads in a cymose arrangement, many flowered, pedunculate with peduncles occasionally articulate though usually ebracteate in upper half, bracteate; bracteoles filiform to filiform-clavate. Flowers sessile, bisexual, monomorphic. Calyx limb 5-lobed; lobes obtuse. Corolla yellow, salverform to slenderly funnelform, pubescent inside; lobes 5, thinly imbricate in bud. Stamens 5, inserted in upper part of corolla tube, partially exerted; filaments short; anthers basifixed. Ovary 2-celled, ovules 4–12 in each cell on axile placentas attached in upper third of septum; stigma obovoid, exerted. Fruiting heads globose. Fruit capsular, obconic, septicidally dehiscent into 2 valves from base to apex with valves separating along sides or from base to apex and away from persistent septum, sometimes later splitting loculicidally into 2 more valves, stiffly cartilaginous, with septum persistent or tardily deciduous, with calyx limb persistent on septum; seeds several, medium-sized, fusiform to spatulate, slightly to rather strongly flattened, winged at both ends.

One species: China, Japan, Myanmar, Thailand.

Ridsdale (loc. cit.) described the arrangement of the corolla lobes in bud as “valvate but subimbricate at the apex”; on the specimens studied these appear to be imbricate with the margins very thinly overlapping, a condition sometimes called “subimbricate” or “thinly imbricate” elsewhere in this treatment (e.g., *Timonius*). Ridsdale described the seeds as “trigonal to tricornute, slightly bilaterally compressed, not winged,” but the seeds on the specimens studied are flattened and shortly winged at the ends (e.g., *Fang 8106*, MO; *Tsui 756*, MO).

**1. *Sinoadina racemosa*** (Siebold & Zuccarini) Ridsdale, *Blumea* 24: 352. 1979.

鸡仔木 jī zāi mù

*Nauclea racemosa* Siebold & Zuccarini, *Abh. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss.* 4: 178. 1846; *Adina asperula* Handel-Mazzetti; *A. mollifolia* Hutchinson; *A. racemosa* (Siebold & Zuccarini) Miquel; *Cornus esquirolii* H. Léveillé; *N. taiwaniana* Hayata; *N. transversa* Hayata.

Semi- to fully deciduous trees, 4–12 m tall; trunk bark gray; branches glabrous. Petiole (1–)3–6(–8) cm, glabrous or puberulent; leaf blade drying thinly leathery, ovate-oblong, or elliptic, (4–)9–15(–25) × (3–)5–10(–18) cm, adaxially shiny and glabrous or infrequently sparsely hirtellous, abaxially glabrous to pilosulous, base cordate to obtuse, sometimes slightly inequilateral, apex acute to acuminate; secondary veins 6–12 pairs, sometimes with foveolate or to pilosulous domatia; stipules (5–)10–15 × 2–5 mm, puberulent to glabrous, lobes

suborbicular. Inflorescence densely puberulent; peduncles 1–3 cm; branched portion 5–10 × 5–10 cm, branched to 1 order; flowering heads 4–8 mm in diam. across calyces, 14–18 mm in diam. across corollas; bracteoles ca. 1 mm. Calyx villosulous; ovary portion ellipsoid-obcuneate, 0.7–1 mm, surrounded at base by a ring of trichomes 0.5–1 mm; limb deeply lobed, lobes spatulate, ca. 0.5 mm, at apex rounded and thickened. Corolla outside densely woolly puberulent; tube (3–)4–5 mm; lobes spatulate to deltoid, 0.5–1 mm, acute to obtuse. Stigma fusiform, 0.3–0.4 mm, exerted for 4–6 mm. Fruiting head 11–15 mm in diam. Capsules obovoid-cuneate, 5–7 mm, sparsely hirtellous; seeds 2.5–3.5 × 0.5–1 mm, often bifid at apex. Fl. and fr. May–Dec.

Sunny watersides, forests; 300–1000(–1500) m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hunan, Jiangsu, Jiangxi, Sichuan, Taiwan, Yunnan, Zhejiang [Japan, Myanmar, Thailand].

The synonym *Cornus esquirolii* was first cited for this species by Lauener and Ferguson (*Notes Roy. Bot. Gard. Edinburgh* 32: 103. 1972), based on a type from Guizhou, China.

## 86. SPERMACOCE Linnaeus, *Sp. Pl.* 1: 102. 1753.

丰花草属 fēng huā cǎo shù

Chen Tao (陈涛); Charlotte M. Taylor

*Bigelovia* Sprengel (1824), not Smith (1819), nor Sprengel (1820), nor *Bigelowia* Rafinesque (1817), nor Candolle (1836, nom. cons.); *Borreria* G. Meyer (1818, nom. cons.), not *Borreria* Acharius (1810) [Fungi].

Herbs, annual or perennial, subshrubs, or low shrubs [rarely dioecious], unarmed. Raphides present. Leaves opposite, sometimes borne on very short axillary stems and these plus long-stem leaves appearing whorled or fascicled, without domatia; stipules persistent, fused to petiole bases or leaves, sheath truncate to broadly rounded or broadly triangular, usually thinly textured, with (1 or)2–11 bristles to multi-fimbriate, bristles occasionally glandular at apex. Inflorescences terminal and/or axillary, capitate or glomerulate, several to many flowered, sessile, bracteate, often partially enclosed in an expanded stipule sheath; bracts usually filiform-laciniate or stipuliform. Flowers sessile or subsessile, bisexual, monomorphic [or rarely distylous or unisexual]. Calyx limb deeply to completely 2- or 4[–8]-lobed, lobes sometimes unequal in pairs. Corolla white sometimes flushed with blue or pink [to sometimes pink, red, blue, or violet], salverform to funnelform, inside variously glabrous throughout, pubescent in throat or throughout, or usually with a ring of pubescence at stamen insertion; lobes 4, valvate in bud [and infrequently with abaxial horns or appendages]. Stamens 4, inserted in corolla throat to near base of tube, included or exerted; filaments short or developed; anthers dorsifixed. Ovary 2-celled, ovules 1 in each cell, axile near middle of septum; stigma capitate or 2-lobed with lobes short to linear, included or exerted. Fruit capsular, ellipsoid to subglobose, septicidally then loculicidally dehiscent with valves remaining joined at base [or sometimes separating completely or remaining connected at apex or partially schizocarpous with 1 valve loculicidal and 1 valve indehiscent], papery to thickly textured, with calyx limb persistent; seeds medium-sized, ellipsoid to subglobose, with ventral (i.e., adaxial) groove, with testa thin, smooth to variously ornamented including minutely pitted to rugose, ruminant, and/or reticulate; endosperm corneous or fleshy; cotyledons leaflike; hypocotyl terete, basiscopic.

About 250–300 species: widespread in tropical to warm temperate regions worldwide with several species widely naturalized; seven species (four introduced) in China.

These species were treated in the genus *Borreria* by W. C. Ko (in FRPS 71(2): 205–210. 1999); *B. shandongensis* as treated by Ko is here considered a synonym of *Diodia teres*. *Borreria* has traditionally been separated from *Spermacoce* based on fruit dehiscence, with both of the fruit valves dehiscent in *Borreria* vs. one dehiscent and one indehiscent in *Spermacoce* (vs. both indehiscent in *Diodia*), but based on pantropical surveys of this group and molecular data the majority of authors today include *Borreria* in *Spermacoce* (Verdcourt, Fl. Trop. E. Africa, Rub. (Pt. 1), 339–374. 1976; Deb & Dutta, J. Econ. Taxon. Bot. 5(5): 1037–1063. 1984; Chaw & Peng, J. Taiwan Mus. 40(1): 71–83. 1987; Dessein, Syst. Stud. Spermacoceae (Ph.D. Diss.), University of Leuven, Belgium, 1–403. 2003). The treatment here follows recent neotropical studies as to the separation of and names used for the adventive neotropical species (Burger & Taylor, Fieldiana, Bot., n.s., 33: 1–333. 1993; C. D. Adams, Flora Mesoamericana, in prep.). In particular, seed coat sculpture or texture is informative at the species level, though it must be observed at high magnification (Dessein, loc. cit.); Chaw and Sivarajan (Bot. Bull. Acad. Sin., n.s., 30: 15–24. 1989) illustrated seed coats of many Chinese species. Pollen is also informative in this group (e.g., Dessein et al., Australian J. Bot. 18: 367–382. 2005) but is incompletely studied.

- 1a. Corolla relatively small, with tube plus lobes 0.5–1 mm, with corolla tube shorter than, ± equal to, or slightly longer than calyx lobes; calyx lobes 2 or 4; mature fruit 0.6–1.1 × 0.3–1 mm.
- 2a. Stem angles narrowly winged; leaf blade ovate or elliptic-oblong, 4–15 mm wide; seed coat apparently covered by numerous fine horizontal striations or ridges ..... 3. *S. exilis*
- 2b. Stems smooth to angled, angles without wings; leaf blade narrowly elliptic-oblong to elliptic, 1–10 mm wide; seed coat with coarse rounded pits arranged in longitudinal (i.e., vertical) rows ..... 5. *S. prostrata*
- 1b. Corollas larger, with tube alone 0.5–10 mm and longer than calyx lobes; calyx lobes 4; mature fruit 1–5 × 1–3.5 mm.
- 3a. Fruit 1–2 × 1–1.5 mm; leaves linear-oblong or narrowly elliptic, 2.5–16 mm wide; corolla tubes 0.5–1.5 mm.
- 4a. Leaves linear-oblong, 2.5–6 mm wide; seeds appearing smooth ..... 6. *S. pusilla*
- 4b. Leaves narrowly elliptic to lanceolate, 4–16 mm wide; seeds transversely ruminant-rugose with irregular deep grooves ..... 7. *S. remota*
- 3b. Fruit 2.2–5 × 1.5–3.5 mm; leaves elliptic, ovate-oblong, oblong-ellipsoid, obovate, or spatulate, 3–40 mm wide.
- 5a. Leaf blade elliptic or ovate-oblong, usually widest near middle, 12–75 × 6–40 mm; plants often drying yellowish green; corolla tube 2–3 mm ..... 1. *S. alata*
- 5b. Leaf blade oblong-elliptic, obovate, or spatulate, usually widest above middle, 10–30 × 3–18 mm; plants usually drying dull green to grayish; corolla tube 2.5–10 mm.
- 6a. Mature seeds 2–2.5 mm, oblong to elliptic-oblong in outline, brown; corolla tube slender, 6.5–10 mm ..... 2. *S. articularis*
- 6b. Mature seeds 2.2–3 mm, elliptic to elliptic-oblong in outline, black; corolla tube funnellform, 2.5–4.5 mm ..... 4. *S. hispida*

**1. *Spermacoce alata*** Aublet, Hist. Pl. Guiane 1: 55. 1775.

阔叶丰花草 kuo ye feng hua cao

*Borreria alata* (Aublet) Candolle; *B. latifolia* (Aublet) K. Schumann; *Spermacoce latifolia* Aublet

Herbs, perennial, erect to weak or clambering, sometimes fleshy, usually drying yellowish green, to 1 m; stems 4-angled, hispidulous or pilosulous and sometimes also hirsute, angles rounded to acute or very narrowly winged, wings entire. Leaves sessile to shortly petiolate; petiole to 4 mm, pilosulous or hirtellous; blade drying papery, elliptic or ovate-oblong, 12–75 × 6–40 mm, both surfaces sparsely to densely hispidulous to pilosulous, base cuneate to obtuse then long decurrent, apex acute or obtuse; secondary veins 5 or 6 pairs; stipules hirtellous to hispidulous, sheath 1–1.5 mm, with 5–9 bristles or narrowly triangular lobes 1–7 mm, ciliate. Inflorescences axillary and infrequently apparently also terminal, 6–15 mm in diam., few to several flowered, notably hispidulous to pilosulous; bracts filiform, 0.5–4 mm. Calyx moderately to densely hirtellous or pilosulous; hypanthium portion ellipsoid to obovoid, ca. 0.5 mm; lobes 4, lanceolate to elliptic or triangular, 1–2 mm. Corolla white tinged with blue to pale purple, funnellform, outside pilosulous to hirtellous; tube 2–3 mm, pubescent in throat; lobes triangular, 1–1.5 mm. Capsules ellipsoid to subglobose, 3–3.5 × 2–3 mm, densely hirtellous and often also hirsute on upper portion, densely puberulent to strigillose on sides, stiffly papery

to cartilaginous, septicidal from apex with valves usually remaining connected at base, then both valves loculicidal through septum; seeds pale brown or dark brown, ellipsoid, ca. 2 × 1 mm, obtuse at both ends, shiny or dull, surface with numerous tiny pits not organized into rows. Fl. and fr. May–Nov.

Naturalized in disturbed ground and wastelands; below 100–800 m. Fujian, Guangdong, Hainan, Taiwan, Zhejiang [apparently native to the Neotropics but exact origin unknown; Antilles, Central America, North America (Mexico, Florida), widespread in tropical South America; naturalized in Africa, S and SE Asia, Australia, Madagascar, and perhaps North America].

The seeds of this species were illustrated by Chaw and Sivarajan (Bot. Bull. Acad. Sin., n.s., 30: 20, f. 25–27. 1989). This species is considered an invasive weed in the area of Guangzhou in Guangdong Province. W. C. Ko (in FRPS 71(2): 207. 1999) described the fruit as septicidal to base at maturity, septum not caducous, or septum of one valve caducous, but there seems to be a confusion here and this description is not accurate for this species.

The names *Spermacoce alata* and *S. latifolia* (or *Borreria alata* and *B. latifolia*) have been treated as distinct species by many authors but synonymized by others, variously under each of these names. There now appears to be only one species here, which takes the name *S. alata*. Aublet's names were published simultaneously; although the names *B. latifolia* and *S. latifolia* have been more often used, these species were apparently first synonymized by Hara and Gould (Enum. Fl. Pl. Nepal, 199–209. 1979) under the name *B. alata*.

**2. *Spermacoce articularis*** Linnaeus f., Suppl. Pl. 119. 1782.

长管糙叶丰花草 chang guan cao ye feng hua cao

*Borreria articularis* (Linnaeus f.) F. N. Williams; *Spermacoce flexuosa* Loureiro.

Herbs, perennial, or subshrubs, prostrate to weakly ascending, perhaps to 50 cm tall; stems subterete to quadrate, glabrescent on sides, angles sharp to winged with wings to 0.1 mm wide, ciliolate to ciliate. Leaves sessile or subsessile; blade drying papery to leathery, oblong-elliptic, obovate, or spatulate, 8–15(–25) × 3–10 mm, both surfaces scaberulous-hispidulous and sometimes also hirtellous or hirsute, base cuneate to obtuse, margins scaberulous and often revolute, apex obtuse or rounded; secondary veins 2 or 3 pairs or not visible; stipules densely puberulent, sheath 1–2 mm, with 5–7 bristles 0.5–2(–6) mm. Inflorescences axillary, 5–8 mm in diam., with 1–6 flowers per axil; bracts linear or infrequently stipuliform, 1–5 mm. Calyx puberulent to hirtellous or scaberulous; hypanthium portion ellipsoid, 0.8–1 mm; lobes 4, linear to narrowly triangular, 1–1.5 mm, ciliolate or ciliate. Corolla perhaps pink to white, very slenderly funnelliform to salverform, glabrous outside; tube (6.5–)9–10 mm, glabrous in throat; lobes triangular, 1–2 mm. Capsules ellipsoid to subglobose, sometimes slightly flattened perpendicular to septum, 2.2–2.5 × 1.5–2.5 mm, puberulent to hirtellous, pilosulous, and/or hispidulous, papery to cartilaginous, septicidal from apex with valves usually remaining connected at base, then both valves loculicidal through septum; seeds brown, oblong to elliptic-oblong in outline, 2–2.5 mm, obtuse at both ends, shiny, surface minutely granular or dimpled. Fl. and fr. May–Oct.

On open sandy lands at lower elevations. Fujian, Guangdong (Nanhai Zhudao), Taiwan (introduced and naturalized) [India, Indonesia, Japan (Ryukyu Islands), Malaysia, Nepal, Pakistan, Philippines, Sri Lanka, Vietnam; Africa, Australia].

The seeds of this species (as circumscribed here) were illustrated by Chaw and Sivarajan (Bot. Bull. Acad. Sin., n.s., 30: 19, f. 17–18. 1989).

This name is here used differently than in many previous floras in this region; the commonly collected plants treated by Chaw and Peng (J. Taiwan Mus. 40(1): 71–83. 1987) and W. C. Ko (in FRPS 71(2): 206–207. 1999) as *Spermacoce articularis* are here treated as *S. hispida*, which is the older name. Overall, there is confusion and/or disagreement about the application of these two names as well as the number of specimens that should be separated among these plants, which have been studied only based on regional floristic work rather than a systematic review of this species group across its entire range. Deb and Dutta (J. Econ. Taxon. Bot. 5(5): 1046–1048. 1984) synonymized *S. hispida* and *S. articularis* and recognized a single species, for which they described the corolla tube as “.3–1.7 mm ... shorter than the corolla lobes” while illustrating correspondingly a corolla with the tube 4–6 mm and several times longer than the corolla lobes. Sivarajan and Nair (Taxon 35: 363–369. 1986), followed by Ridsdale (in Dassanayake, Revis. Handb. Fl. Ceylon 12: 332–341. 1998) and Mill (Fl. Bhutan 2(2): 817–820. 1999), recognized two species in this group; however, a number of individual Chinese plants have some characters of each of these so their distinctions are problematic in our region. Two distinct groups of plants are separable in our region using the characters listed in the key to species above, and the protologues of these two names each correspond to one of these groups; the treatment here generally follows the annotations of Fosberg (in herb.).

**3. *Spermacoce exilis*** (L. O. Williams) C. D. Adams, Fieldiana, Bot., n.s., 33: 316. 1993.

二萼丰花草 er e feng hua cao

*Borreria exilis* L. O. Williams, Phytologia 28: 227. 1974, based on *B. gracilis* L. O. Williams, Phytologia 26: 487. 1973, not Scheele (1844), nor *Spermacoce gracilis* Ruiz & Pavon (1798); *B. repens* Candolle; *S. decandollei* Deb & R. M. Dutta, nom. illeg. superfl.; *S. mauritiana* Gideon; *S. repens* (Candolle) Fosberg & D. A. Powell (1980), not Willdenow ex Chamisso & Schlechtendal (1828), nor Sessé & Mocifio (1893), nor Larrañaga (1923).

Herbs, annual to perhaps perennial, slender, creeping to weakly ascending, to 30 cm tall; stems 4-angled, puberulent to glabrescent, angles winged, wings 0.1–0.5 mm wide, ciliate or ciliolate. Leaves subsessile to shortly petiolate; petiole to 1.5 mm, puberulent to glabrescent; blade drying membranous, ovate or elliptic-oblong, 0.7–30 × 4–15 mm, sparsely puberulent to glabrous throughout or pilose to hispid along midrib abaxially, base obtuse to cuneate, apex acute to obtuse; secondary veins 2 or 3 pairs; stipules pilosulous or hirtellous to glabrescent, sheath 0.5–1 mm, with 5–10 bristles 0.5–2 mm, often glandular. Inflorescences terminal and in uppermost leaf axils, 3–6 mm in diam., several to many flowered; bracts numerous, filiform, 0.5–1.5 mm. Calyx hirtellous to glabrescent; hypanthium portion obovoid, ca. 0.3 mm; lobes 2, linear-lanceolate to triangular, 0.4–0.9 mm. Corolla white, rotate to shortly tubular, 0.5–0.6 mm, outside glabrous, bearded in throat; lobes spatulate triangular, ± as long as tube. Capsules ellipsoid, weakly to strongly flattened at right angles to septum, 1–1.1 × 0.8–1 mm, glabrescent, membranous and sometimes somewhat hyaline, septicidal from apex then both valves loculicidal through septum or sometimes fragmenting; seeds brownish yellow, ellipsoid, ca. 0.8 × 0.4 mm, obtuse at both ends, shiny, surface apparently with numerous fine horizontal striations or ridges (at 10×; but actually with minute transverse pits, visible at 40×). Fl. and fr. almost year-round.

Naturalized in disturbed humid sites at low elevations. Hainan, Hong Kong, Taiwan [apparently native to the Neotropics but exact origin unknown; India, Indonesia, Nepal, Sri Lanka, Vietnam; Africa, Antilles, Australia, Central America, Indian Ocean islands (Mauritius), North America (Mexico), Pacific islands, N South America].

The seeds of this species were illustrated in detail by Chaw and Sivarajan (Bot. Bull. Acad. Sin., n.s., 30: 20, f. 28–30. 1989, as *Spermacoce mauritiana*). The taxonomy and circumscription of this adventive species here follows Burger and Taylor (Fieldiana, Bot., n.s., 33: 316. 1993). The illustration presented by Deb and Dutta (J. Econ. Taxon. Bot. 5(5): 1045, f. 2. 1984, as *S. decandollei*) seems to be based on a mixed collection of *S. exilis* and *S. prostrata* according to the circumscription of these species here. Both *S. exilis* and *S. prostrata* were formerly included in a broadly circumscribed, morphologically heterogeneous “*Spermacoce ocymoides* Burm. f.” Several authors have concluded that this last name applies to a species found only in SE Asia and was incorrectly applied to American and adventive plants (Dessein, Syst. Stud. Spermacoceae (Ph.D. Diss.), University of Leuven, Belgium, 1–403. 2003, and references cited there); presumably the species treated by Bakhuizen f. in the Fl. Java is “true” *S. ocymoides*.

The description of *Spermacoce exilis* here includes observations from specimens from outside China; this species has probably been introduced to China more than once, thus it seems useful to include the variation found in adjacent regions that may yet be found in China.

**4. *Spermacoce hispida*** Linnaeus, Sp. Pl. 1: 102. 1753.

糙叶丰花草 cao ye feng hua cao

*Borreria hispida* (Linnaeus) K. Schumann.

Herbs, annual or perennial, or subshrubs, prostrate to perhaps weakly ascending, apparently often fleshy, to 50 cm tall; stems subterete to usually markedly quadrate, glabrous to puberulent or pilosulous on sides, angles cartilaginous to winged, wings to 0.1 mm wide, ciliolate, hispidulous, or ciliate. Leaves sessile to shortly petiolate; petiole to 4 mm, hirtellous throughout or ciliolate in lines; blade drying papery to leathery, oblong-elliptic, obovate, or spatulate, 10–30(–40) × 5–15(–18) mm, both surfaces hirtellous to scaberulous, hispidulous, and/or hirsute, base cuneate to obtuse and usually long decurrent, margin scaberulous or ciliolate and often revolute, apex acute, obtuse, or rounded; secondary veins 2 or 3(or 4) pairs or not visible; stipules moderately to densely puberulent, hirtellous, and/or pilosulous often in lines, sheath 1–3 mm, with 5–7 bristles 1–5 mm. Inflorescences axillary, 5–15 mm in diam., with 1–6 flowers per axil; bracts linear or infrequently stipuliform, 1–5 mm. Calyx puberulent to hirtellous or scaberulous; hypanthium portion ellipsoid, 0.8–1 mm; lobes 4, linear-lanceolate to narrowly triangular, 1–1.5 mm, ciliolate or ciliate. Corolla pink, purple, or white, funnellform, outside glabrous or hispidulous to pilosulous on upper part; tube 2.5–4.5 mm, glabrous in throat; lobes elliptic-oblong, lanceolate, or triangular, 1–1.8 mm. Capsules ellipsoid to subglobose, sometimes weakly flattened perpendicular to septum, 2.5–5 × 2.5–3.5 mm, puberulent, hirtellous, pilosulous, and/or hispidulous, papery to cartilaginous, septicidal from apex with valves usually remaining connected at base then both valves loculicidal through septum, with calyx lobes sometimes enlarging, up to 2.2 mm; seeds black, elliptic to elliptic-oblong in outline, 2.2–3 mm, obtuse at both ends, shiny to dull, surface minutely granular or dimpled. Fl. and fr. Mar–Dec.

On open sandy lands at lower elevations; sea level to 100 m. Fujian, Guangdong, Guangxi, Hainan, Taiwan [India, Indonesia, Malaysia, Philippines, Sri Lanka, Vietnam; Australia].

This name is applied here to most of the plants treated by W. C. Ko (in FRPS 71(2): 206–207. 1999) as "*Borreria articularis*"; see the comments about these two species above, under *Spermacoce articularis*. The seeds of this species (as circumscribed here) were illustrated by Chaw and Sivarajan (Bot. Bull. Acad. Sin., n.s., 30: 19, f. 22–24. 1989). The leaf measurements included above in parentheses are taken from Wang & Li W05246 (Taiwan, MO!), which is an exceptionally robust plant.

**5. *Spermacoce prostrata*** Aublet, Hist. Pl. Guiane 1: 58. 1775.

匍匐丰花草 pu fu feng hua cao

*Borreria prostrata* (Aublet) Miquel.

Herbs, annual or probably perennial, slender, weakly ascending to erect at least at ends of stems, to 65 cm tall; stems rounded to subquadrate, smooth to sharply angled and/or longitudinally sulcate, scaberulous to glabrescent. Leaves sessile; blade drying membranous, narrowly elliptic-oblong to elliptic, 10–30(–45) × 1–7(–10) mm, puberulent and/or scaberulous to glabrescent throughout or sometimes pilose along midrib abaxially,

base obtuse to cuneate, apex acute to obtuse; secondary veins 2–5 pairs; stipules puberulent, hirtellous, or glabrescent, sheath 0.5–1 mm, with 5–9 bristles 0.5–2 mm, often glandular. Inflorescences terminal and in uppermost leaf axils, several to many flowered, 3–4 mm in diam.; bracts numerous, filiform, 0.5–1 mm. Calyx glabrescent; hypanthium portion obovoid, ca. 0.3 mm; lobes 2 or 4, narrowly triangular, 0.3–0.7 mm. Corolla white, rotate to shortly tubular, 0.7–1 mm, outside glabrous, pubescent in throat; lobes spatulate-triangular, ± as long as tube. Capsules ellipsoid, weakly to strongly flattened at right angles to septum, 0.6–0.9 × 0.3–0.4 mm, glabrescent, membranous and sometimes somewhat hyaline, septicidal from apex, then both valves loculicidal through septum or sometimes fragmenting; seeds brownish yellow, ellipsoid, ca. 0.5 × 0.2 mm, obtuse at both ends, with coarse rounded pits arranged in longitudinal (i.e., vertical) rows. Fl. and fr. almost year-round.

Naturalized in disturbed wet sites at low elevations. Hainan, Hong Kong, Taiwan [apparently native to the Neotropics but exact origin unknown; India, Indonesia, Sri Lanka; Antilles, Central America, Indian Ocean islands (Mauritius), North America (Mexico), Pacific islands, N South America].

This species has been widely confused with and/or combined with *Spermacoce exilis*, and has sometimes been misidentified as *S. ocyroides*; see the discussion under *S. exilis*, above.

**6. *Spermacoce pusilla*** Wallich in Roxburgh, Fl. Ind. 1: 379. 1820.

丰花草 feng hua cao

*Borreria pusilla* (Wallich) Candolle.

Herbs, apparently annual, slender, erect, to 60 cm tall; stems subterete to 4-angled, glabrous to densely scaberulous at least along angles or ridges. Leaves sessile; blade drying papery to leathery, linear-oblong, 12–50 × 2.5–6 mm, adaxially densely scaberulous to hispidulous, abaxially glabrous or often pilosulous, hirtellous, or hispidulous along midrib, base generally straight (i.e., not tapering), margins often revolute at least when dry, apex acute to acuminate; secondary veins 2 or 3 pairs or not visible; stipules densely pilosulous or scaberulous often with unusual clavate trichomes, sheath 1–2.5 mm, with 5–7 bristles 2–6.5 mm. Inflorescences terminal and axillary at most stem nodes, 5–12 mm in diam., several to many flowered; bracts filiform, 1–4 mm. Calyx glabrescent to densely puberulent or hirtellous; hypanthium portion turbinate, ca. 0.5 mm; lobes 4, linear-lanceolate, 1–1.5 mm. Corolla funnellform, white tinged red on upper parts, outside glabrous; tube 1.2–1.5 mm, glabrous in throat; lobes linear-lanceolate to triangular, 0.8–1.5 mm, sometimes pubescent inside near tips. Capsules sometimes shortly stipitate, oblong or subobovate to ellipsoid, usually weakly flattened perpendicular to septum, 1–2 × 1–1.5 mm, glabrescent at base, glabrescent to densely hirtellous near apex, septicidal from apex with valves often remaining connected at base, then both valves loculicidal through septum and often partially splitting abaxially; seeds dark brown, narrowly oblong in outline, 1.3–2.2 × ca. 0.5 mm, obtuse at both ends, shiny, smooth. Fl. and fr. Aug–Dec.

Grasslands and grassy slopes at lower elevations; 100–1500 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Jiangxi, Tai-

wan, Yunnan, Zhejiang [Bhutan, India, ?Indonesia, Malaysia, Myanmar, Nepal, Pakistan, Philippines, Sri Lanka, Thailand, Vietnam; introduced in tropical Africa].

This species was discussed and well illustrated for Taiwan by Chaw and Peng (J. Taiwan Mus. 40(2): 57–59. 1987); its seeds were illustrated in detail by Chaw and Sivarajan (Bot. Bull. Acad. Sin., n.s., 30: 18, f. 10–11. 1989).

These plants were treated by W. C. Ko (in FRPS 71(2): 208. 1999) as *Spermacoce stricta* Linnaeus f. (*Borreria stricta* (Linnaeus f.) G. Meyer), following previous usage by various authors (see discussion in Chaw & Peng, loc. cit.), but as detailed by Sivarajan and Nair (Taxon 35: 363–369. 1986) the identity of the name *S. stricta* is not at all clear and very likely actually applies to a species of *Hedyotis*. W. C. Ko (loc. cit.) described the seeds of this species as transversely striate/grooved and with one end mucronate, another end obtuse; however, the seeds are smooth with both ends obtuse to rounded on all specimens studied, and as described by Dessein (Syst. Stud. Spermacoceae (Ph.D. Diss.), University of Leuven, Belgium, 1–403. 2003).

Sivarajan and Nair (loc. cit.) separated the Indian plants treated in "*Spermacoce stricta*" into two species, *S. pusilla* and a newly described species, *S. ramanii* Sivarajan & R. V. Nair. They gave the range of *S. ramanii* only as India, although they considered several additional names synonymous, with a consequent tacit expansion of its range to Thailand, New Guinea, and Java. Dessein (loc. cit.) discussed the separation of these and concluded that there appear to be two species in India but only one variable species in Africa; he found the contrasting character states in all possible combinations in Africa and did not adopt the name *S. ramanii* for any African plants. The Chinese plants seen appear to comprise one well-delimited species and are here all treated as *S. pusilla*; however, as with the African plants, several of the features that Sivarajan and Nair used to separate *S. ramanii*, which are largely vegetative characters, are found on some Chinese plants in various combinations with other features. The name *S. ramanii* is, therefore, not synonymized nor used here for any Chinese plants; it has been cited for China by the Kew Rubiaceae checklist (Govaerts et al., World Checkl. Rubiaceae; <http://www.kew.org/wcsp/rubiaceae/>; accessed on 15 Sep 2010) but without documentation of the report.

7. *Spermacoce remota* Lamarck, Tabl. Encycl. 1: 273. 1792.

光叶丰花草 *guang ye feng hua cao*

*Borreria assurgens* (Ruiz & Pavon) Grisebach; *B. remota* (Lamarck) Bacigalupo & E. L. Cabral; *Spermacoce assurgens* Ruiz & Pavon.

Herbs, perennial, or subshrubs, ascending to erect, to 65 cm tall; stems subterete to subquadrate, sulcate and/or ridged, glabrous or ciliolate on angles. Leaves sessile to petiolate; petiole to 3 mm, glabrescent; blade drying papery, narrowly elliptic to lanceolate, 10–45 × 4–16 mm, puberulent to glabrescent, base acute to cuneate, apex acute; secondary veins 2 or 3 pairs; stipules puberulent or hirtellous to glabrescent, sheath 1–3 mm, with 5–7 bristles 0.5–2 mm. Inflorescences terminal and in uppermost leaf axils, 5–12 mm in diam., many flowered; bracts numerous, filiform, 0.5–1 mm. Calyx puberulent or hirtellous to glabrescent; hypanthium portion obovoid, ca. 0.5 mm; lobes 4, narrowly triangular to linear, 0.8–1 mm. Corolla white, funnel-form, outside glabrous or puberulent on lobes; tube 0.5–1.5 mm, pubescent in throat; lobes triangular, 1–1.5 mm. Capsules ellipsoid, weakly to strongly flattened at right angles to septum, 1.8–2 × 1–1.2 mm, hirtellous or puberulent, papery, septicidal from apex with valves usually remaining connected at base, then both valves loculicidal through septum and often splitting abaxially; seeds brownish yellow, ellipsoid, 1.5–1.8 × 0.8–1 mm, obtuse at both ends, somewhat shiny, transversely ruminant-rugose with irregular deep grooves. Fl. and fr. Jun–Jan.

Naturalized in disturbed wet sites; below 100–300 m. Guangdong, Taiwan [apparently native to the Neotropics; India, Indonesia, Singapore, Sri Lanka, Thailand, Vietnam; Antilles, Australia, Central America, Indian Ocean islands (Mauritius), North America (Mexico), Pacific islands, N South America].

This widely naturalized species was reported from Taiwan by Chaw and Peng (J. Taiwan Mus. 40(1): 71–83. 1987), who noted that it has been widely misidentified as "*Borreria laevis*," but that name applies to a distinct Asian species of restricted range. The seeds of this species were illustrated by Chaw and Sivarajan (Bot. Bull. Acad. Sin., n.s., 30: 20, f. 34–36. 1989, as *Spermacoce assurgens*).

## 87. SPERMADICTYON Roxburgh, Pl. Coromandel 3: 32. 1815.

香叶木属 *xiang ye mu shu*

Chen Tao (陈涛); Charlotte M. Taylor

*Hamiltonia* Roxburgh.

Shrubs, erect or clambering, unarmed, fetid when bruised. Raphides present. Leaves opposite, decussate, without domatia; stipules persistent, interpetiolar or shortly united around stem, triangular. Inflorescences terminal, cymose, paniculate, or corymbose, many flowered, pedunculate, bracteate. Flowers subsessile or sessile, bisexual, distylous. Calyx limb deeply 5-lobed. Corolla white, blue, pink, or violet, slenderly funnelform with tube prolonged, variously glabrous or pubescent inside; lobes 5, valvate in bud. Stamens 5, inserted in corolla throat, included in long-styled form, exserted in short-styled form; filaments short to developed; anthers apparently basifixed. Ovary 5-celled, ovules 1 in each cell, erect, basal, anatropous; stigma 5-lobed, included in short-styled flowers, exserted in long-styled flowers. Fruit drupaceous becoming capsular or perhaps schizocarpous, oblong-ellipsoid, dry, with valves or perhaps mericarps separating septically from apex, with calyx limb persistent; pyrenes or perhaps mericarps 5, 1-celled, each with 1 seed, ellipsoid; seeds medium-sized, ellipsoid-oblong or triangular; testa reticulate; embryo straight; radicle basiscopic.

One species: Bangladesh, Bhutan, India, Nepal, Pakistan; cultivated more widely, including in China.

W. C. Ko (in FRPS 71(2): 119. 1999) estimated six species of *Spermadictyon*, but all other authors seen report only one species. Ko described the fruit as having a septum disappearing early and the seeds as having a loose aril, but the meaning of these is not entirely clear and does not correspond to morphology described elsewhere.

**1. *Spermadictyon suaveolens*** Roxburgh, Pl. Coromandel 3: 32. 1815.

香花木 *xiang hua mu*

*Hamiltonia suaveolens* (Roxburgh) Roxburgh.

Subshrubs, 1–3 m tall, perhaps rather fleshy; branches somewhat flattened to quadrangular or subterete, tomentulose to glabrescent. Petiole 12–18 mm, pilosulous or tomentulose to glabrescent; leaf blade drying papery, elliptic-lanceolate to elliptic or ovate, 13–20 × 4–6.5 cm, adaxially glabrous or pilosulous to puberulent to tomentulose, abaxially tomentulose to villosulous with pubescence denser on principal veins, base acute to cuneate or rounded, apex acute to obtuse; secondary veins 10–16 pairs; stipules triangular to broadly triangular, 2–4 mm, tomentulose to glabrous, obtuse to subacute. Inflorescences 5–25 cm, tomentulose to villosulous; peduncles 3–5 cm;

bracts ovate to triangular or oblanceolate, 1–4 mm. Calyx densely pilosulous; ovary portion cylindrical to ellipsoid, ca. 1 mm; limb lobed essentially to base; lobes linear-lanceolate, 1.2–2 mm, acute. Corolla blue or white, outside densely tomentulose to villosulous; tube 8–12 mm; lobes ovate to triangular, 1.5–3 mm, acute. Fruit ellipsoid to ovoid, 3–4 mm, densely pilosulous.

Cultivated in gardens and perhaps naturalized. Xizang [Bangladesh, Bhutan, India, Nepal, Pakistan; cultivated more widely].

Raizada and Bennet (Indian Forester 108(2): 302–303. 1982) recognized two varieties of this species, *Spermadictyon suaveolens* var. *suaveolens* with “pure white” flowers and *S. suaveolens* var. *azureum* (Wallich) Bennet & Raizada, based on *S. azureum* Wallich, with “azure-blue flowers.” Other authors have not separated these color forms taxonomically but regard the color difference as due only to pigmented vs. albino flowers, a distinction generally not recognized taxonomically any more and not recognized here.

## 88. *SPIRADICLIS* Blume, Bijdr. 975. 1826–1827.

螺序草属 *luo xu cao shu*

Chen Tao (陈涛); Charlotte M. Taylor

Herbs, annual or perennial, or subshrubs, unarmed. Raphides present. Leaves opposite, sometimes clustered and appearing whorled, rosulate, or pseudovericillate, isophyllous to anisophyllous, without domatia; stipules persistent to caducous, interpetiolar, triangular, entire to 2(–5)-lobed. Inflorescences terminal and/or pseudoaxillary, cymose to paniculiform with axes slender and dichasial or often scorpioid, several to many flowered, pedunculate, bracteate or bracts reduced. Flowers sessile to pedicellate, bisexual, usually if not always distylous. Calyx with ovary portion usually 5-ridged or -winged, limb 5-lobed. Corolla white, pink, purple, or red, campanulate, funnelform, urceolate, or tubular, inside usually pubescent in throat and with pubescent ring near middle; lobes 5, in bud valvate or induplicate-valvate, often winged or keeled dorsally, sometimes notably pinnatinerved. Stamens 5, inserted below middle of corolla tube and included in long-styled flowers, inserted in throat or middle of corolla tube and partially exerted in short-styled flowers; filaments short to developed; anthers dorsifixed. Ovary 2-celled, ovules numerous in each cell on peltate axile placentas attached to middle of septum; stigmas 2-lobed, included to shortly exerted in long-styled flowers, included and positioned near middle of corolla tube in short-styled flowers. Fruit capsular, subglobose, often 5-ridged to -winged, with apical portion prolonged into beak, dehiscing loculicidally and often also simultaneously or subsequently septicial from top, dividing partially to completely into 2 or 4 valves with walls usually persistent, papery to stiff, with calyx limb persistent, sometimes elongating; seeds numerous, small, angled; testa reticulate or alveolate; embryo minute; endosperm fleshy.

At least 40 species: Bhutan, China, India, Indonesia, Myanmar, Vietnam; 35 species (31 endemic, one of unconfirmed occurrence) in China.

Robbrecht (Opera Bot. Belg. 1: 1–271. 1988; Opera Bot. Belg. 6: 1–200. 1993) accepted earlier conclusions that *Spiradiclis* is related to *Ophiorrhiza*; a more recent study based on molecular data suggests that the situation may be more complex and calls into question the separation of these genera (Rydin et al., Pl. Syst. Evol. 278: 101–120. 2009). H. S. Lo (in FRPS 71(1): 86. 1999) described the corolla lobes as valvate in bud, but they were described as induplicate-valvate by Bakhuizen f. (Fl. Java 2: 289. 1965). This genus does not appear to be well known at all. It has only been studied regionally, in particular by H. S. Lo et al. (Acta Bot. Austro Sin. 1: 27–36. 1983), H. S. Lo (Bull. Bot. Res., Harbin 6(4): 31–53. 1986), Deb and Rout (Candollea 44: 225–229. 1989), H. S. Lo (Bull. Bot. Res., Harbin 18: 275–283. 1998), and R. J. Wang (Novon 12: 420–423. 2002). Ma et al. (J. Trop. Subtrop. Bot. 13(3): 264–270. 2005) studied seed morphology of sixteen *Spiradiclis* species and found partial correlation with the infrageneric classification of Lo.

H. S. Lo (loc. cit. 1998: 275–276) recognized two subgenera, distinguished as follows:

*Spiradiclis* subg. *Spiradiclis*: ellipsoid to linear-oblong capsules that are 2–4 × as long as wide and have straight valves, including eight (or possibly nine or ten) species in China;

*Spiradiclis* subg. *Sinospiradiclis* H. S. Lo: subglobose capsules that are ± as long as wide and have the valves ultimately twisted, including the remaining Chinese species.

One subsequently described species, *Spiradiclis chuniana* R. J. Wang, was not classified to subgenus when it was published because the fruit were unknown. The key here follows that of H. S. Lo in FRPS (71(1): 86–88. 1999), apparently intended as a schematic outline of the genus classification, with some changes: here the full range of variation that is given in the descriptions has been added to the key leads, and a few species have been moved to different sections within the key based on Lo’s descriptions. This key does not fully distinguish all the species; however, it cannot be improved on with the information now available and is here presented to summarize in English the existing information on Chinese *Spiradiclis* and to highlight problematic areas of its taxonomy.

- 1a. Capsules narrowly ellipsoid, ellipsoid, oblanceoloid, narrowly oblong, or linear-oblong, 2–4 × as long as wide, with valves becoming twisted (dehiscence unknown in *S. baishaiensis*, *S. laxiflora*, *S. longzhouensis*) (*S.* subg. *Spiradiclis*).
- 2a. Capsules linear-oblong, oblanceoloid, or narrowly oblong, 2–4 × as long as wide, glabrous or puberulent.
- 3a. Stems and leaves glabrous; petioles 3–4.5 cm; stipule unlobed ..... 23. *S. "microcarpa"*
- 3b. Stems and abaxial leaf veins glabrescent, scaberulous, puberulent, villosulous, or strigillose; petioles 0.2–1 cm; stipules deeply 2-lobed.
- 4a. Corolla tube 2–2.5 mm; corolla lobes apparently perhaps keeled dorsally; fruit 5–6 mm, with 2 valves or these later partly splitting ..... 4. *S. caespitosa*
- 4b. Corolla tube 3–4 mm; corolla lobes smooth dorsally; fruit 2.5–4.5 mm with 4 valves.
- 5a. Capsules 2.5–4 mm; stipules persistent ..... 1. *S. arunachalensis*
- 5b. Capsules 4–4.5 mm; stipules caducous ..... 9. *S. cylindrica*
- 2b. Capsules narrowly ellipsoid or ellipsoid, ca. 2 × as long as wide, glabrous, pilosulous, or villosulous.
- 6a. Leaves tomentose or pilosulous at least abaxially; capsules glabrous to pilosulous or villous.
- 7a. Peduncle 5–9 cm; calyx lobes 3–4 mm, longer than fruit; capsules glabrous ..... 2. *S. baishaiensis*
- 7b. Peduncle 0.1–0.5 cm; calyx lobes ca. 1 mm, shorter than fruit; capsules villosulous ..... 10. *S. emeiensis*
- 6b. Leaves glabrous; capsules glabrous.
- 8a. Stems with 2 lines of dense hispidulous hairs ..... 22. *S. malipoensis*
- 8b. Stems glabrous or sparsely evenly pubescent.
- 9a. Leaves 10–15 cm, with secondary veins 9–11 pairs ..... 16. *S. laxiflora*
- 9b. Leaves 15–21 cm, with secondary veins 16–23 pairs ..... 20. *S. longzhouensis*
- 1b. Capsules subglobose, ellipsoid, to ovoid, or subglobose-obconic, ± as long as wide, valves remaining straight (fruit unknown in *S. chuniana*, *S. corymbosa*, *S. ferruginea*, *S. fusca*, *S. longipedunculata*, *S. napoensis*, *S. rubescens*, *S. spathulata*, *S. xizangensis*; fruit dehiscence unknown in *S. hainanensis*, *S. longibracteata*, *S. oblanceolata*, *S. villosa*) (*S.* subg. *Sinospiradiclis*).
- 10a. Leaves cordate, cordulate, subtruncate, or broadly obtuse at base.
- 11a. Leaves 0.6–1.8 cm; plants creeping.
- 12a. Calyx lobes 2–4 mm, in fruit 2 or 3 × as long as capsule ..... 13. *S. guangdongensis*
- 12b. Calyx lobes 1.2–1.5 mm, in fruit ± equal to or shorter than capsule ..... 14. *S. hainanensis*
- 11b. Leaves 1.5–13 cm, at least some more than 1.8 cm; plants erect or creeping.
- 13a. Corolla 20–21.5 mm; leaves 1.5–4 cm; plants creeping ..... 33. *S. umbelliformis*
- 13b. Corolla 6–9 mm; leaves 3–13 cm; plants ascending or acaulescent.
- 14a. Plants with leaves distributed along developed stems; leaves 3–6.5 × 1.6–3 cm, broadly obtuse to truncate at base ..... 5. *S. chuniana*
- 14b. Plants acaulescent or with short stems, with leaves often clustered at base of plant; leaves 5–13 × 2–5.5 cm, cordate or cordulate at base ..... 7. *S. cordata*
- 10b. Leaves acute, cuneate, obtuse, or rounded at base.
- 15a. Corolla with tube 13.5–23 mm.
- 16a. Calyx lobes 1–1.5 mm, ± as long as or shorter than corolla "tube" (i.e., hypanthium portion together with unlobed basal part of calyx limb).
- 17a. Stems developed with leaves borne at developed internodes ..... 30. *S. scabrida*
- 17b. Stems short or hardly developed, with leaves clustered at base ..... 31. *S. spathulata*
- 16b. Calyx lobes 1.6–10 mm, longer than corolla "tube."
- 18a. Leaves glabrous on both surfaces; flowers dark red ..... 6. *S. coccinea*
- 18b. Leaves pubescent (hirsute, pilose, strigose, hispidulous, hirtellous) on one or both surfaces and/or ciliate marginally; flowers red, bluish purple, white, purplish red, purplish white, or pink (flowers unknown in *S. xizangensis*).
- 19a. Corolla tube 19–22 mm.
- 20a. Calyx lobes generally equal in size; leaves adaxially densely hispidulous-strigose; corolla bluish purple, tube 19–21 mm ..... 28. *S. purpureocaerulea*
- 20b. Calyx lobes unequal in size; leaves adaxially sparsely puberulent or glabrous; corolla red or purplish red, tube 21–22 mm.
- 21a. Secondary leaf veins 18–29 pairs; calyx lobes 3–10 mm; corolla tube ca. 22 mm ..... 18. *S. longibracteata*
- 21b. Secondary leaf veins 9–11 pairs; calyx lobes 3.5–4.5 mm; corolla tube ca. 21 mm ..... 29. *S. rubescens*
- 19b. Corolla tube 12–18 mm (only known in bud in *S. napoensis*).
- 22a. Calyx lobes unequal in length, one distinctly longer and/or wider than others; corolla tubes glabrescent or uniformly pubescent over broad areas inside.

- 23a. Corolla pubescent inside; leaf secondary veins 8–15 pairs ..... 11. *S. ferruginea*  
 23b. Corolla glabrescent inside; leaf secondary veins ca. 7 pairs ..... 35. *S. xizangensis*  
 22b. Calyx lobes equal or subequal in size; corolla tubes with 1 or 2 discrete white villous rings of pubescence inside.  
 24a. Leaves rounded, obtuse, or acute at apex, with 18–29 pairs of secondary veins; corolla sparsely purplish red pubescent outside; stipules broadly ovate ..... 18. *S. longibracteata*  
 24b. Leaves acuminate at apex, with 6–10 pairs of secondary veins; corolla glabrous or with 5 lines of pubescence outside; stipules subulate to linear.  
 25a. Leaves lanceolate, ovate, subelliptic, or subelliptic-oblong, yellowish brown on lower surface when dry; stipules and bracteoles 2–3 mm; corolla with 5 lines of pubescence outside, lobes narrowly winged on dorsal surface ..... 15. *S. howii*  
 25b. Leaves narrowly ovate to broadly ovate, pale on lower surface when dry; stipules 2–8 mm and bracteoles 6–10 mm; corolla glabrous outside, lobes smooth on dorsal surface ..... 25. *S. napoensis*  
 15b. Corolla shorter, tube 2–9 mm (flowers unknown in *S. bifida*, *S. villosa*; only buds known in *S. microphylla*).  
 26a. Stems and inflorescences glabrous.  
 27a. Leaves narrowly elliptic-oblong or oblanceolate, 3.5–4.5 × as long as wide; stipules long triangular; stems with developed internodes ..... 26. *S. oblanceolata*  
 27b. Leaves obovate, broadly obovate, oblong-elliptic, oblong-lanceolate, or subelliptic, 1.5–3 × as long as wide; stipules triangular, triangular-orbicular, suborbicular, or long triangular; stem internodes developed to reduced.  
 28a. Stipules suborbicular or triangular-orbicular, cuspidate and 2-lobed; stem internodes developed ..... 19. *S. longipedunculata*  
 28b. Stipules triangular to long triangular, at apex acuminate; stem internodes developed or reduced.  
 29a. Leaves 1.5–3.5 cm wide, with 10–13 pairs of secondary veins; petioles 0.5–1.5 cm; corolla tube ca. 9 mm ..... 12. *S. fusca*  
 29b. Leaves 3–4.5 cm wide, with 7–9 pairs of secondary veins; petioles 1–4 cm; corolla tube ca. 5 mm ..... 21. *S. luochengensis*  
 26b. Stems and inflorescences pubescent.  
 30a. Stems short, with leaves crowded at base of plant.  
 31a. Flowers subsessile; corolla pubescent inside ..... 17. *S. loana*  
 31b. Flowers on pedicels 1–5 mm; corolla glabrous inside ..... 32. *S. tomentosa*  
 30b. Stems prolonged, erect to prostrate, with leaves separated by developed internodes.  
 32a. Calyx and capsules glabrous or subglabrous; leaves 10–21 cm, with 15–19 pairs of secondary veins ..... 3. *S. bifida*  
 32b. Calyx and capsules pubescent; leaves 1–25 cm, with 4–17 pairs of secondary veins.  
 33a. Capsules villous; calyx lobes ca. 4 mm ..... 34. *S. villosa*  
 33b. Capsules puberulent, pilosulous, pilose, or hispidulous; calyx lobes 0.3–1.5 mm.  
 34a. Leaves 6.5–14 cm, with 11–17 pairs of secondary veins; corolla tube 7.5–9 mm ..... 8. *S. corymbosa*  
 34b. Leaves 1–5 cm, with 4–9 pairs of secondary veins; corolla tube ca. 2 mm (only known in bud in *S. microphylla*).  
 35a. Leaves 1–3 × 0.5–4 cm, with 4–7 pairs of secondary veins; fruit with 4 valves ..... 24. *S. microphylla*  
 35b. Leaves 3–5 × 1.5–3 cm, with ca. 9 pairs of secondary veins; fruit valves 2, sometimes tardily splitting into 4 ..... 27. *S. petrophila*

**1. *Spiradiclis arunachalensis*** Deb & Rout, Candollea 44: 225. 1989.

藏南螺序草 zang nan luo xu cao

*Spiradiclis caespitosa* Blume f. *subimmersa* H. S. Lo.

Herbs, perennial, usually prostrate and rooting on basal

nodes; stems glabrous to densely villosulous. Petiole 0.2–1 cm; leaf blade drying papery, oblanceolate to lanceolate-elliptic, 1.5–7.5 × 0.3–1.8 cm, adaxially glabrescent to scaberulous or strigillose marginally and on principal veins, abaxially strigillose to puberulent along principal veins and glabrescent on lamina, base cuneate to acute, apex acute; secondary veins 6–11

pairs; stipules persistent, deeply 2-lobed, lobes narrowly triangular, 4–10 mm, strigillose to glabrescent, acute. Inflorescences dichasially branched 1 or 2 times, strigillose or puberulent; peduncles 2–6 cm; axes scorpioid; bracts linear-lanceolate, 1.5–3 mm. Flowers subsessile. Calyx glabrous; hypanthium portion obconic to cylindrical, 1.7–2.2 mm; limb 0.6–1 mm, deeply lobed; lobes triangular to ovate. Corolla white, shortly tubular, outside puberulent to glabrous; tube 3–4 mm; lobes ca. 1 mm. Capsules narrowly oblong to narrowly oblanceoloid, 2.5–4 × 1.5–2 mm, glabrous, valves 4, becoming twisted. Fl. and fr. Sep.

Moist understories of forests, rice fields at forest margins. Guangxi, Guizhou, Yunnan [India].

See comments about the identity and circumscription of this species under *Spiradiclis caespitosa*.

**2. *Spiradiclis baishaiensis*** X. X. Chen & W. L. Sha, Bull. Bot. Res., Harbin 8(3): 107. 1988.

百色螺序草 bai se luo xu cao

Herbs, perennial, ascending, 20–50 cm tall; stems usually unbranched. Petiole 1.5–4 cm, yellow pilosulous or -villosulous; leaf blade drying papery, adaxially brown, abaxially straw-yellow, ovate-elliptic, obovate, or oblanceolate, 7–10 × 3–6 cm, adaxially glabrous, abaxially densely yellowish brown tomentose, base cuneate to acute and usually slightly inequilateral, apex acute or acuminate; secondary veins 11–23 pairs; stipules persistent, ovate-lanceolate, 9–13 × 4–6 mm, obtuse. Inflorescence cymose to paniculiform, glabrous, purplish red; peduncles 5–9 cm; branched portion 5–8 cm, dichasial; bracts linear-lanceolate, 8–15 × 1.5–2 mm; bracteoles linear, 3–5 mm; pedicels 3–4 mm. Calyx glabrous; hypanthium portion ovoid to ellipsoid, ca. 2.5 mm; limb lobed to base; lobes linear, 3–4 mm. Corolla purplish red, becoming brownish yellow when dry, tubular or tubular-funnelform, outside glabrous; tube 8–13 mm, inside pubescent near middle or bearded in throat; lobes ovate-oblong, ca. 2 mm. Capsules ellipsoid, ca. 3 × 1.5 mm. Fl. May.

• Forests. Guangxi.

In the protologue this species was said to be similar to *Spiradiclis oblanceolata*, although this species was classified in *S.* subg. *Spiradiclis* while *S. oblanceolata* was classified in *S.* subg. *Sinospiradiclis*. The protologue of *S. baishaiensis* apparently described short-styled flowers (cf. f. 3, f. 4, and description of style as half as long as corolla and anthers exerted); however, H. S. Lo (in FRPS 71(1): 106. 1999) reported this to be a description of a long-styled flower. The protologue described the corollas as pubescent near the middle inside, while H. S. Lo described the corollas as bearded in the throat.

**3. *Spiradiclis bifida*** Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 41: 310. 1872.

大叶螺序草 da ye luo xu cao

Herbs, to 0.5 m tall, apparently perennial; stems ascending, ?villous. Petiole 1–3 cm, pubescent; leaf blade drying thinly papery, elliptic or elliptic-oblong, 10–21 × 3–6.5 cm, adaxially sparsely pilose to subglabrous, abaxially pubescent along veins, base obtuse then decurrent, apex acuminate or subcaudate; secondary veins 15–19 pairs; stipules subulate, caudate. Inflorescences paniculate, to 20 cm, ?villous; axes numerous, 1–2 cm, scorpioid; bracts minute. Flowers shorter than 5 mm. Capsules subglobose, ca. 2 mm in diam., valves 4.

Wet places in forests. S and SW Yunnan [NE India].

**4. *Spiradiclis caespitosa*** Blume, Bijdr. 975. 1826–1827.

螺序草 luo xu cao

Herbs, perennial, usually rooting at basal nodes but ascending in upper parts; stems puberulent to glabrescent. Petiole 0.3–1 cm; leaf blade drying papery, elliptic to elliptic-ovate, 1–6.5 × 1–3 cm, puberulent to glabrescent on both surfaces, base cuneate to obtuse, apex obtuse to acute; secondary veins 3–7 pairs; stipules deciduous or caducous, deeply 2-lobed, lobes narrowly triangular to linear, 4–5 mm, puberulent to glabrescent. Inflorescences cymose, puberulent to strigillose, unbranched or dichasially branched 1 time; peduncle 1–4.5 cm; axes scorpioid; bracts filiform. Flowers subsessile. Calyx glabrous to puberulent; hypanthium portion oblanceoloid to cylindrical, 1.5–2 mm; limb 0.5–1 mm, deeply lobed; lobes triangular. Corolla white, shortly tubular, outside glabrous; tube 2–2.5 mm; lobes 1–1.5 mm, dorsally keeled. Capsules linear-oblong to oblanceoloid, 5–6 × 1.5–1.7 mm, valves 2, becoming twisted, sometimes later partially splitting.

Moist shady sites, often along streams; near sea level to 1200 m. Perhaps present in China, no confirmed material seen [Indonesia (Java)].

This species is here circumscribed more narrowly and somewhat differently than done by H. S. Lo (in FRPS 71(1): 107–110. 1999); it has not yet been confirmed from China and is included here for comparison, based on the description of Bakhuizen f. (Fl. Java 2: 289. 1965) who studied plants in the type region. Authors outside China have separated the Himalayan plants with 4-valved capsules as *Spiradiclis cylindrica* (Deb & Rout, Candollea 44: 225–229. 1989; Springate & Wright, Fl. Bhutan 2(2): 772–774. 1999) and are followed here; H. S. Lo et al. (Acta Bot. Austro Sin. 1: 31. 1983) synonymized this name under *S. caespitosa* f. *cylindrica*.

H. S. Lo (Acta Bot. Austro Sin. 1: 31–32. 1983) described several forms of *Spiradiclis caespitosa*. In FRPS (H. S. Lo, loc. cit. 1999: 110), f. *subimmersa* was distinguished by its narrowly lanceolate to lanceolate leaves 3–7 × 0.7–1.5 cm. The plants included in f. *subimmersa* were subsequently treated as a species, *S. arunachalensis*, by Deb and Rout (loc. cit.: 225). These plants correspond to *S. cylindrica* as circumscribed here, rather than to *S. caespitosa* under which the varietal name was actually published. Most of the specimens studied and described by Deb and Rout were not seen by Lo, and similarly Lo's material was not seen by them. *Spiradiclis arunachalensis* is provisionally treated here pending further study.

**5. *Spiradiclis chuniana*** R. J. Wang, Novon 12: 423. 2002.

焕镛螺序草 huan yong luo xu cao

Herbs, annual, to 8 cm tall, mostly unbranched, perhaps ascending; stems densely villous. Petiole 1–3 cm, villous; leaf blade ovate, 3–6.5 × 1.6–3 cm, sparsely villous on both surfaces, base broadly obtuse to truncate and often oblique, apex rounded to obtuse then mucronate; secondary veins 10–12 pairs; stipules persistent, villous, 2–5-lobed, lobes linear, 5–10 mm. Inflorescences cymose, several flowered, villosulous; peduncle 2.5–6 cm; branched portion ca. 1.5 cm; axes mixed dichasial and scorpioid; bracts linear, 1.2–2 mm; pedicels to 5 mm. Flowers distylous, sessile to pedicellate. Calyx puberulent; hypanthium portion obconic to ellipsoid, ca. 1 mm; lobes narrowly triangular, ca. 1 mm. Corolla white, funnelform, puberulent outside; tube ca. 7.5 mm, inside with villous ring at middle and

sparsely pubescent above; lobes ca. 1.5 mm. Immature capsules apparently subglobose. Fl. Aug.

• Shady and wet places in forests on slopes of limestone hills; ca. 400 m. Guangxi (Nonggang).

This species was not classified to subgenus in the protologue because the mature fruit were unknown, and predicting the states of unknown characters is problematic in many Rubiaceae (e.g., Razafimandimbison & Taylor, *Novon* 10: 71–73. 2000).

**6. *Spiradiclis coccinea*** H. S. Lo, *Bull. Bot. Res.*, Harbin 6(4): 38. 1986.

红花螺序草 hong hua luo xu cao

Herbs, erect, ca. 40 cm tall, presumably perennial; stems grayish brown when dry, glabrous or subglabrous. Petiole 1–2 mm; leaf blade drying papery, adaxially grayish brown, abaxially grayish yellow, narrowly elliptic-oblong or elliptic-oblong, 4.5–9 × 1.3–3 cm, glabrous on both surfaces, base cuneate, apex obtuse to acute; secondary veins 6–9 pairs; stipules triangular, rapidly narrowed to subulate, long acuminate apex. Inflorescence cymose, ca. 1 cm, with more than 10 flowers; peduncle very short. Flowers distylous. Calyx glabrescent; hypanthium portion obconic, 1.2–1.5 mm; lobes narrowly lanceolate, 1.7–2 mm, with gland at each side of base inside. Corolla dark red, slenderly tubular-salverform, outside glabrous or puberulent; tube 15–18 mm, inside with pilose ring above stamens; lobes broadly ovate to suborbicular, 4.5–6 mm. Capsules subglobose, 4.5–5.5 mm in diam., valves 4. Fl. Aug.

• On rocks in dense forests. Guangxi (Longzhou).

**7. *Spiradiclis cordata*** H. S. Lo & W. L. Sha, *Acta Bot. Austro Sin.* 1: 34. 1983.

心叶螺序草 xin ye luo xu cao

Herbs, fleshy, low, apparently perennial, acaulescent or stems short, densely hirsute. Leaves often clustered at base of plant; petiole 1–7 cm, densely villosulous to hirsute; blade drying papery, pale to green, elliptic-ovate to elliptic-oblong, 5–13 × 2–5.5 cm, adaxially sparsely hispidulous, abaxially hispidulous to villosulous with pubescence denser along veins, base cordate to cordulate, apex obtuse to rounded; secondary veins 15–19 pairs; stipules deciduous, hispidulous to villosulous, deeply 2-lobed, lobes linear, 4–8 mm. Inflorescences cymose to paniculate, puberulent to strigillose; peduncles 6–16 cm; principal axes 4–9, 1–3 cm, mostly scorpioid; bracts linear or subulate, ca. 2 mm. Flowers subsessile. Calyx densely puberulent to pilosulous; hypanthium portion obconic, 0.5–0.8 mm; lobes triangular, ca. 0.8 mm. Corolla white, tubular-funnelform, outside puberulent to glabrescent; tube ca. 5 mm, villosulous above middle inside; lobes subtriangular, ca. 1 mm. Capsules brown, subglobose, ca. 1.8 mm in diam., valves 4, flat. Fl. Aug, fr. Aug–Nov.

• Rocks at roadsides; ca. 400 m. Guangxi.

**8. *Spiradiclis corymbosa*** H. S. Lo, *sp. nov.*

密花螺序草 mi hua luo xu cao

Type: China. Guangxi: Daxin, Taiping, 4 Jun 1977, *D. L. Chao* 2–64 (holotype, GXMI).

Validating Latin description: that of “*Spiradiclis corymbosa* W. L. Sha e [sic!] X. X. Chen” (H. S. Lo, *Bull. Bot. Res.*, Harbin 18: 276. 1998).

Herbs, 24–30 cm tall, perhaps perennial, unbranched, perhaps ascending; stems densely pubescent. Leaves in slightly unequal opposite pairs; petiole 0.5–2.5 cm, pubescent; blade drying papery, elliptic to long elliptic, 6.5–14 × 2–4.7 cm, both surfaces pilose along veins, base cuneate, apex acute; secondary veins 11–17 pairs; stipules long triangular, to 23 mm, ciliate, apex subulate. Inflorescences corymbose, densely many flowered, densely pubescent; peduncles 4.5–9 cm; axes usually scorpioid; bracts linear, 3–18 mm, ciliate; bracteoles linear, ca. 2 mm, ciliate; pedicels to 2 mm. Flowers sessile to pedicellate. Calyx pubescent; hypanthium portion turbinate, ca. 1.5 mm; lobes long triangular, ca. 1 mm, ciliate. Corolla red, pubescent inside and out; tube 7.5–9 mm; lobes ovate, 1.5–2 mm. Capsules unknown. Fl. Jun.

• Rocks in forests on limestone hills. Guangxi.

This name was previously published by H. S. Lo (loc. cit.) but not validly so because the type was not indicated in accordance with Art. 37.6 and 37.7 of the *Vienna Code*. This species as circumscribed here reportedly (H. S. Lo in *FRPS* 71(1): 100. 1999) comprises the Chinese plants previously treated as *Spiradiclis leptobotrya* (Drake) Pitard var. *longiflora* Merrill, in particular as treated under that name by H. S. Lo et al. (*Acta Bot. Austro Sin.* 1: 29. 1983).

**9. *Spiradiclis cylindrica*** Wallich ex J. D. Hooker, *Fl. Brit. India* 3: 76. 1880.

尖叶螺序草 jian ye luo xu cao

*Spiradiclis caespitosa* Blume f. *cylindrica* (Wallich ex J. D. Hooker) H. S. Lo.

Herbs, perennial, often prostrate and rooting on basal nodes, at apices ascending; stems densely villosulous. Petiole 0.3–1 cm; leaf blade drying papery, elliptic, narrowly elliptic, or lanceolate-elliptic, 2–8 × 1–4 cm, adaxially scaberulous to glabrescent, abaxially scaberulous, puberulent, or villosulous at least along veins, base obtuse to acute, apex acute; secondary veins 7–9 pairs; stipules caducous, strigillose to puberulent, 2–10 mm, deeply 2-lobed, lobes narrowly triangular to linear. Inflorescences cymose to paniculate, puberulent; peduncle 2–8 cm; principal axes dichasially branched 1 or 2 times, higher order axes scorpioid; bracts linear, 1–5 mm. Flowers subsessile. Calyx glabrous to puberulent; hypanthium portion obconic to oblanceoloid, 1.5–2 mm; limb ca. 1 mm, lobed nearly to base; lobes triangular. Corolla white, shortly tubular, outside glabrous; tube ca. 3.5 mm; lobes ca. 1 mm, smooth dorsally. Capsules linear-oblong to oblanceoloid, 4–4.5 × 1–1.7 mm, valves 4, becoming twisted.

Ravines in forests, rice fields at forest margins; 1200–1500 m. Guangxi, Guizhou, Xizang, Yunnan [Bhutan, Myanmar, N Vietnam].

See comments regarding the circumscription and recognition of this species under *Spiradiclis caespitosa*.

**10. *Spiradiclis emeiensis*** H. S. Lo, *Acta Bot. Austro Sin.* 1: 36. 1983.

峨嵋螺序草 e mei luo xu cao

Herbs, decumbent, rather fleshy, presumably perennial; stems densely pubescent. Petiole 1–4 cm, densely pubescent; leaf blade drying thinly papery, grayish green, ovate to elliptic, 4–9 × 2–4 cm, both surfaces sparsely pubescent or often densely

so along abaxial veins, base cuneate then often decurrent, apex acute to obtuse; secondary veins 9–12 pairs; stipules persistent, deltoid, acuminate. Inflorescence cymose to subcapitate, villous; peduncle 0.1–0.5 cm; branched portion 1–2 cm, with axes dichasial; bracteoles subulate, 1.5–2 mm. Flowers subsessile. Calyx pilosulous to villous; hypanthium portion ellipsoid-cylindrical, ca. 1.5 mm; limb deeply lobed; lobes triangular-lanceolate, ca. 1 mm. Corolla white, urceolate-tubular, white villous outside; tube 3.5–4 mm; lobes lanceolate to elliptic, 2–2.5 mm. Capsules narrowly ellipsoid, ca. 6 × 3 mm, pilosulous to villous, valves 4, becoming slightly twisted. Fl. Jun, fr. Aug.

- Dense forests. Sichuan, Yunnan.

This species was described based on fruiting material; later H. S. Lo (Guihaia 11: 102. 1991) provided a detailed description of the inflorescences and flowers, which apparently represent the short-styled form of a distylous species.

- 1a. Infructescence 1–2 cm, subsessile;  
capsules villous ..... 10a. var. *emeiensis*  
1b. Infructescence ca. 3.5 cm; peduncles  
ca. 0.5 cm; capsules pilosulous ..... 10b. var. *yunnanensis*

#### 10a. *Spiradiclis emeiensis* var. *emeiensis*

峨嵋螺序草(原变种) *e mei lu xu cao* (yuan bian zhong)

Infructescence 1–2 cm, subsessile. Capsules villous.

- Dense forests. Sichuan (Emei Shan).

#### 10b. *Spiradiclis emeiensis* var. *yunnanensis* H. S. Lo, Guihaia 11: 102. 1991.

河口螺序草 *he kou lu xu cao*

Infructescence ca. 3.5 cm; peduncles ca. 0.5 cm. Capsule pilosulous.

- Dense forests. Yunnan (Hekou).

#### 11. *Spiradiclis ferruginea* D. Fang & D. H. Qin, Bull. Bot. Res., Harbin 13: 334. 1993.

锈茎螺序草 *xiu jing lu xu cao*

Herbs, prostrate to ascending, 3–20 cm tall, presumably perennial; stems densely ferruginous pubescent. Petiole 0.5–5 cm, densely ferruginous pubescent; leaf blade drying papery, ovate, ovate-elliptic, or rarely elliptic, 3–12 × 1.5–5 cm and slightly anisophyllous, both surfaces densely pubescent, base rounded and sometimes inequilateral, apex acuminate or obtuse; secondary veins 8–15 pairs; stipules ovate-lanceolate, 8–10 mm, sparsely pubescent, ciliate. Inflorescence cymose, 7–10-flowered, densely pubescent; peduncle 3–6 cm; bracteoles lanceolate-linear, 5–7 mm; pedicels 1–7 mm. Flowers distylous, pedicellate. Calyx pubescent; hypanthium portion turbinate, ca. 1 mm; lobes narrowly lanceolate, unequal, one lobe ca. 5 mm, others ca. 4 mm, ciliate, with a gland in each sinus. Corolla pale purplish red, tubular-funnelform, outside and inside pubescent; tube ca. 16 mm; lobes ovate-triangular, ca. 3 mm. Capsules unknown. Fl. Mar.

- On calcareous rocks in forests; ca. 1200 m. Guangxi (Napo).

#### 12. *Spiradiclis fusca* H. S. Lo, Guihaia 11: 100. 1991.

两广螺序草 *liang guang lu xu cao*

Herbs, 30–80 cm tall, perhaps perennial, perhaps ascending; stems glabrous, when dry brownish yellow. Petiole 0.5–1.5 cm; leaf blade drying thinly papery, adaxially grayish brown, abaxially brownish yellow, oblong-lanceolate to sub-elliptic, 4–9 × 1.5–3.5 cm, adaxially glabrous, abaxially pilose on principal veins, base cuneate and somewhat decurrent, apex acuminate or subacute; secondary veins 11–13 pairs; stipules triangular, 6–7 mm, long acuminate, usually 2-parted. Inflorescences paniculiform, many flowered, together with peduncles 7–10 cm, glabrous; bracteoles subulate or linear, 2–3 mm; pedicels short. Calyx glabrous; hypanthium portion obconic, ca. 1 mm; lobes sublanceolate, ca. 1.5 mm. Corolla white or pale purple, funnelform, glabrous outside; tube ca. 9 mm; lobes subtriangular, ca. 3 mm, apically rostrate-incurved. Capsules unknown. Fl. Mar.

- Limestone hills. Guangdong (Lianxian), Guangxi (Guilin).

The characters given in the protologue, in particular the proportional length of the calyx lobes to the corolla, do not seem to correspond to the figure of this species presented by H. S. Lo in FRPS (71(1): 102, t. 22, f. 6–10. 1999). This species was keyed by Lo in FRPS (loc. cit.: 87) as having pubescent stems and inflorescences, but the description (loc. cit.: 99–100) differed from that and so the species is here included in a different section of the key.

#### 13. *Spiradiclis guangdongensis* H. S. Lo, Acta Bot. Yunnan. 9: 299. 1987.

广东螺序草 *guang dong lu xu cao*

Herbs, creeping, perhaps perennial, ascending at apices; stems sparsely to densely pubescent. Petiole 2–6 mm, pubescent; leaf blade drying papery, leaden to pale gray, cordiform-rounded to broadly ovate, 0.7–1.5(–1.8) × 0.5–1.2 cm, adaxially sparsely hirsute, abaxially usually glabrous or subglabrous, base cordulate to broadly obtuse, apex subacute; secondary veins 3–5 pairs; stipules deeply 2-lobed, glabrescent, lobes linear-subulate, 2–3 mm. Inflorescence 1–3-flowered, puberulent to pilosulous; peduncles short; bracteoles linear, ca. 1.7 mm; pedicels 1–2 mm. Flowers distylous, pedicellate. Calyx hispidulous to glabrescent; hypanthium portion obconic, ca. 1 mm; lobes oblong-lanceolate, ca. 2 mm, with gland in each sinus. Corolla white, slenderly funnelform, subglabrous outside; tube ca. 11 mm, in throat densely villous; lobes subovate, ca. 4 mm, sparsely pinnatinerved. Capsules subglobose-obconic, ca. 1.4 mm, persistent calyx lobes 3–4 mm, valves 4, straight. Fl. early spring.

- Dense forests, forest margins. Guangdong, Guangxi (Hechi).

As noted by H. S. Lo in the protologue, this species is very similar to *Ophiorrhiza exigua* and, in fact, was confused with it in the original description of that species.

#### 14. *Spiradiclis hainanensis* H. S. Lo, Acta Bot. Yunnan. 9: 301. 1987.

海南螺序草 *hai nan lu xu cao*

Herbs, creeping, perhaps perennial, ascending at apices; stems densely villosulous. Petiole 0.1–0.5 mm, densely villosulous; leaf blade drying thinly papery, adaxially grayish black,

abaxially pale gray, cordiform-orbicular to ovate, 0.6–1.3 × 0.6–0.9 cm, both surfaces hispidulous at least on principal veins to glabrescent, base cordulate to subtruncate, apex obtuse; secondary veins 3 or 4 pairs; stipules deciduous, narrowly triangular, 1.5–2.5 mm glabrescent. Inflorescences cymose, 2- or 3-flowered, glabrescent, dichasial; peduncle 6–7 mm. Flowers subsessile. Calyx densely villosulous (Hainan plants) to glabrescent (Yunnan plants); hypanthium portion subglobose to oblanceoloid, ca. 1.5 mm; lobes narrowly lanceolate, 1.2–1.5 mm. Corolla white, funnellform, outside glabrous; tube ca. 8 mm; lobes lanceolate, 1–1.5 mm. Immature capsules ellipsoid-ovoid, ca. 2 mm, dehiscence unknown. Fl. Jul, young fr. Oct.

- Dense evergreen forests; 2100–2600 m. Hainan (Sanya), Yunnan.

The description of the flowers and stipules here as well as the extension of the geographic range into Yunnan are taken from two specimens provisionally identified here as *Spiradiclis hainanensis*, *Li Heng 12449* and *12511*.

**15. *Spiradiclis howii*** H. S. Lo, Bull. Bot. Res., Harbin 6(4): 41. 1986.

宽昭螺序草 kuan zhao luo xu cao

Herbs, ascending, perennial, or subshrubs; stems subglabrous to densely pilose. Petiole 0.6–1.5 cm, densely pubescent; leaf blade drying papery, adaxially grayish green, abaxially yellowish brown, lanceolate, ovate, subelliptic, or subelliptic-oblong, 2.5–6.5(–9) × 1–2(–3) cm, adaxially strigose-hirsute, below villosulous along principal veins, base obtuse to sometimes subrounded, apex acuminate and usually subfalcate; secondary veins 6–8(–10) pairs; stipules subulate-linear, 2–3 mm, acuminate. Inflorescence cymose, many flowered, densely pubescent; peduncle 1–2.5 cm; bracteoles linear-lanceolate, 2–2.5 mm; pedicels 1–2.5 mm. Flowers distylous, pedicellate. Calyx pilosulous; hypanthium portion subobconic, 0.7–0.8 mm; limb deeply lobed; lobes narrowly lanceolate, rigid, 3–5 mm, equal or slightly unequal. Corolla white becoming golden yellow when dry, subtubular, outside with 5 hispidulous or hirsutulous lines; tube 13.5–15.5 mm, inside with villous ring near middle and pubescent above and through throat; lobes triangular-ovate, ca. 1.5 mm, apically thickened-rostrate, dorsally narrowly winged. Capsules subglobose, 3.5–4 mm in diam., pilosulous, valves 4. Fl. Sep.

- Rocks in forests; 1400–1500 m. Yunnan.

**16. *Spiradiclis laxiflora*** W. L. Sha & X. X. Chen, Acta Bot. Austro Sin. 1: 35. 1983.

疏花螺序草 shu hua luo xu cao

Herbs, perennial, erect or ascending, 10–25 cm tall; stems glabrous. Petiole 3.5–5 cm, glabrous; leaf blade drying papery, adaxially green, abaxially pale, elliptic or obovate-elliptic, 10–15 × 3–5 cm, both surfaces glabrous, base acute and decurrent, apex acute to acuminate; secondary veins 9–11 pairs; stipules ovate-triangular, ca. 1 cm, 2-lobed, lobes aristate-acuminate. Inflorescences and flowers not seen. Infructescence paniculate, ca. 25 cm; peduncle ca. 7 cm; axes dichasially branched 1–3 times then scorpioid; bracteoles lanceolate or linear-lanceolate, 5–17 mm. Capsules ellipsoid, ca. 3 × 1.5 mm, glabrous. Fr. Jun.

- Sparse forests on limestone hills. Guangxi (Longzhou).

**17. *Spiradiclis loana*** R. J. Wang, Novon 12: 420. 2002.

猷瑞螺序草 xian rui luo xu cao

Herbs, erect, to 15 cm tall, acaulescent with leaves crowded at base; stems pubescent. Petiole 1–4.5 cm, pubescent; leaf blade oblanceolate, elliptic, or obovate, 6–12 × 1.2–3 cm, adaxially pilose to hispid, abaxially glabrous and pubescent, base acute to cuneate, apex acute to obtuse; secondary veins ca. 10 pairs; stipules persistent, triangular to deeply 2-lobed, segments 5–10 mm, pubescent. Inflorescences cymose, many flowered, pubescent; peduncle 6–10 cm; bracts linear, ca. 1 mm. Flowers distylous, subsessile. Calyx with hypanthium portion obconic, ca. 1 mm; lobes triangular, ca. 1 mm, acute. Corolla white, tubular-funnelform, puberulent outside; tube 5–10 mm, inside with villous ring at middle and sparsely strigillose above; lobes triangular, 1–1.2 mm, acute. Capsules subglobose, ca. 2 mm in diam., valves 4. Fl. Jul–Sep, fr. Aug–Oct.

- Forests on limestone mountains; 200–300 m. Guangxi.

**18. *Spiradiclis longibracteata*** S. Y. Liu & S. J. Wei, Acta Phytotax. Sin. 32: 362. 1994.

长苞螺序草 chang bao luo xu cao

Herbs, presumably perennial, decumbent in lower part and ascending above, sometimes subacaulescent with leaves clustered at base; stems densely villous. Petiole 6–22 mm; leaf blade obovate-lanceolate or oblanceolate, 4–18 × 1–6 cm, adaxially sparsely pubescent, abaxially densely pilose along veins, base acute, apex rounded, obtuse, or acute; secondary veins 18–22(–29) pairs; stipules persistent, broadly ovate, 2- or 4-lobed. Inflorescence cymose, densely many flowered, pubescent; peduncles 7–15 cm; bracts linear-lanceolate, 10–15 mm. Flowers distylous. Calyx pubescent; hypanthium portion ca. 1.5 mm; lobes generally equal and 2–2.5 mm in long-styled form, unequal and 3–10 mm in short-styled form. Corolla purplish red, sparsely purplish red pubescent outside; tube 16–18 mm in long-styled form, ca. 22 mm in short-styled form, inside with villous ring near middle and another at base; lobes ovate. Capsules globose, 2.5–3 mm, pilose. Fl. Apr, fr. Aug–Oct.

- Wet places in forests. Guangxi.

The markedly differing sizes and forms of the calyx and corollas between the long-styled and short-styled flowers are notable.

**19. *Spiradiclis longipedunculata*** W. L. Sha & X. X. Chen, Acta Bot. Austro Sin. 1: 35. 1983.

长梗螺序草 chang geng luo xu cao

Herbs, unbranched, ascending, presumably perennial; stems glabrous. Petiole 3–6 cm, glabrous; leaf blade drying papery, adaxially dark green, and abaxially yellowish brown, obovate or oblong-elliptic, 9–16 × 4–7.5 cm, glabrous on both surfaces, base cuneate, apex acute; secondary veins 1–13 pairs; stipules suborbicular or triangular-orbicular, 8–15 × 5–10 mm, glabrous, cuspidate and 2-lobed, lobes 4–8 mm. Inflorescences cymose-paniculate, ca. 34 cm, many flowered, glabrous; peduncles 15–22 cm; bracts linear, ca. 4 mm. Calyx glabrous; hypanthium portion ovoid, ca. 1.5 mm; lobes ca. 0.3 mm. Corolla pale yellow, tubular, outside glabrous; tube ca. 4 mm, bearded in throat. Capsules unknown. Fl. Apr.

- Guangxi (Daxin).

**20. *Spiradiclis longzhouensis*** H. S. Lo, Guihaia 11: 99. 1991.

龙州螺序草 long zhou lu xu cao

Shrubs or perhaps subshrubs, robust; stems glabrous or sparsely pubescent. Leaves clustered on upper parts of stems; petiole 3–4.5 cm, turning black when dry; blade drying papery, olive-green, abaxially pale, elliptic or elliptic-oblong, 15–21 × 4–8.5 cm, glabrous, base usually decurrent, apex abruptly acuminate; secondary veins 16–23 pairs; stipules subovate, ca. 10 mm, parallel veined. Inflorescence and flowers not seen. Infructescence ca. 15 cm, lax; bracteoles linear, 3–5 mm; pedicels 5–10 mm. Capsules ellipsoid, ca. 3.5 × 1.7 mm, glabrous, persistent calyx lobes linear, 2–2.5 mm. Fr. Apr.

- On rocks in dense forests. Guangxi (Longzhou).

**21. *Spiradiclis luochengensis*** H. S. Lo & W. L. Sha, Acta Bot. Austro Sin. 1: 34. 1983.

桂北螺序草 gui bei lu xu cao

Herbs, 20 cm or taller, presumably perennial, sometimes subcaulescent with leaves grouped at base; stems glabrous. Petiole 1–4 cm, glabrous, reddish brown when dry; leaf blade drying papery, broadly obovate, 5–11 × 3–4.5 cm, both surfaces glabrous, base obtuse then decurrent, apex acute, obtuse, or rounded; secondary veins 7–9 pairs; stipules long triangular, glabrous, acuminate. Inflorescences cymose, many branched, many flowered, glabrous; peduncles slender, 7–10 cm; pedicels short. Calyx purple, glabrous; hypanthium portion ca. 0.5 mm; lobes triangular-ovate, ca. 1 mm. Corolla white becoming orange when dry, tubular-funnelform, outside glabrous; tube ca. 5 mm; lobes lanceolate-oblong, 2–2.5 mm. Capsules ovoid-globose, ca. 3 mm, valves 4. Fl. and fr. Apr–Jun.

- Shady places at streamsides. Guangxi.

**22. *Spiradiclis malipoensis*** H. S. Lo, Guihaia 11: 98. 1991.

滇南螺序草 dian nan lu xu cao

Herbs, presumably perennial, 20–25 cm tall, decumbent and rooting at base but ascending in upper parts; stems with 2 lines of dense hispidulous hairs. Petiole 0.5–1 cm, glabrous; leaf blade drying papery, olive-green, lanceolate-oblong or ovate-elliptic, 4.5–8 × 1.5–3.5 cm, glabrous, base cuneate to obtuse and shortly decurrent, apex obtuse then abruptly acuminate; secondary veins 10 or 11 pairs; stipules lanceolate-linear or linear, 5–8 mm, acuminate. Inflorescences and flowers not seen. Infructescences cymose, 2.5–3 cm, glabrescent; peduncle ca. 1 cm; pedicels 3–4 mm. Capsules white, ellipsoid, 5.5–6 mm, glabrous, valves 4, becoming slightly twisted. Fr. Nov–Dec.

- Dense forests; ca. 1100 m. Yunnan (Malipo).

**23. *Spiradiclis "microcarpa"*** H. S. Lo, Bull. Bot. Res., Harbin 18: 276. 1998.

小果螺序草 xiao guo lu xu cao

Herbs, apparently ascending, presumably perennial, often turning yellow when dry; stems glabrous. Petiole 3–4.5 cm, glabrous; leaf blade drying papery, adaxially leaden gray, obovate or elliptic-obovate, 5–8 × 3–4 cm, both surfaces glabrous, base obtuse then decurrent, apex obtuse to acute; secondary veins 6

or 7 pairs; stipules persistent, triangular to lanceolate, ca. 4 mm, glabrous, obtuse to acute. Inflorescences and flowers not seen. Infructescence paniculate, glabrous, branched dichasially to several orders; peduncle ca. 10 cm; branched portion ca. 4 cm; bracts narrowly triangular, 2–5 mm. Capsules subsessile, linear-oblong to oblanceoloid, ca. 2 × 0.5–0.6 mm, glabrous or puberulent, valves 4, becoming twisted. Fr. Jul.

- Shady places on limestone hills; ca. 100 m. Guangxi (Daxin).

The name *Spiradiclis "microcarpa"* was not validly published by H. S. Lo (loc. cit.) because what should have been the indication of type merely cited "Guangxi: Daxin, circ. 100 m alt[.], non collelector [sic!] s. n." without using the word "holotype" or "type" or an equivalent and without specifying the herbarium in which the type was conserved (*Vienna Code*, Art. 37.6 and 37.7). It has not been possible to locate a specimen from the gathering cited by Lo.

**24. *Spiradiclis microphylla*** H. S. Lo, Acta Bot. Austro Sin. 1: 34. 1983.

小叶螺序草 xiao ye lu xu cao

Herbs, ascending, presumably perennial; stems pubescent. Petiole 0.4–1 cm, pubescent; leaf blade drying thinly papery, brown, ovate, 1–3 × 0.5–1.4 cm, glabrous or pilose on both surfaces, base obtuse then decurrent, apex obtuse to acute; secondary veins 4–7 pairs; stipules subulate-lanceolate, acuminate or caudate-acuminate. Inflorescences cymose, several flowered, with axes scorpioid; peduncles 2–5 cm; bracts lanceolate or subulate-lanceolate, 1–2 mm. Calyx pilose to puberulent; hypanthium portion ca. 0.8 mm; limb deeply lobed; lobes ca. 0.7 mm. Corolla white, shortly tubular, ca. 2.5 mm; lobes ovate-triangular, carinate on dorsal surface. Capsules subglobose, valves 4. Fl. Sep–Oct.

- Sparse forests. Jiangxi (Longnan).

This species was keyed by H. S. Lo (in FRPS 71(1): 88. 1999) based on its glabrous stems and inflorescences, but the description (loc. cit.: 101) reported it as pubescent. The key here is adjusted accordingly.

**25. *Spiradiclis napoensis*** D. Fang & Z. M. Xie, Acta Phytotax. Sin. 40: 154. 2002.

那坡螺序草 na po lu xu cao

Herbs, ca. 65 cm tall, presumably perennial, procumbent at base, ascending above; stems moderately to densely curved pubescent. Leaves somewhat anisophyllous and clustered near top of stem; petiole 0.7–2 cm, densely curved pubescent; blade drying thinly papery to submembranous, adaxially dark green, abaxially pale, narrowly ovate to broadly ovate, 4–7 × 1.5–3.5 cm, adaxially pilosulous to glabrescent, abaxially glabrescent or curved pubescent along principal veins, base rounded to obtuse then decurrent, apex acuminate; secondary veins 8–10 pairs; stipules linear-subulate, 2–8 mm, glabrous, 2-lobed, lobes ca. 1 mm. Inflorescences cymose, 8–10-flowered, densely curved pubescent; peduncles 0.3–0.5 cm; axes 1–4 mm, puberulent; bracteoles linear, 6–10 mm, glabrous. Flowers distylous. Calyx puberulent to glabrescent; hypanthium portion ellipsoid, ca. 2 mm; limb deeply lobed; lobes narrowly triangular, ca. 2.5 mm, with a gland in each sinus. Corolla in bud white tinged with pink, subtubular, glabrous outside; tube ca. 12 mm, inside villous in throat; lobes subovate, ca. 5 mm, acute. Capsules unknown. Fl. Apr–May.

• Forests in valleys of limestone hills; ca. 1000 m. Guangxi (Napo).

Details of the long-styled and short-styled flowers are given in the protologue.

**26. *Spiradiclis oblanceolata*** W. L. Sha & X. X. Chen, Acta Bot. Austro Sin. 1: 35. 1983.

长叶螺序草 chang ye luo xu cao

Herbs, erect, unbranched, 13–25 cm tall, presumably perennial; stems glabrous. Petiole 3–5 cm, glabrous; leaf blade drying papery, oblanceolate or narrowly elliptic-oblong, 7–17 × 2–4 cm, glabrous on both surfaces, base cuneate, apex acute; secondary veins 9–12 pairs; stipules long triangular, ca. 8 mm, glabrous, 2-lobed, lobes ca. 3 mm. Inflorescences paniculate, many flowered, ca. 20 cm, glabrous; peduncles 9–11 cm; bracts linear, ca. 3 mm. Calyx with hypanthium portion ovoid, ca. 2 mm. Corolla white, outside glabrous; tube ca. 5 mm, bearded in throat. Capsules ovoid, ca. 2 mm, glabrous. Fl. and fr. Apr–Jun.

• Rocks in forests. Guangxi.

**27. *Spiradiclis petrophila*** H. S. Lo, Acta Bot. Austro Sin. 1: 33. 1983.

石生螺序草 shi sheng luo xu cao

Herbs, to 30 cm tall, apparently perennial, often procumbent at base, ascending above; stems densely pilosulous to tomentulose. Petiole 0.5–1.5 cm, densely pilosulous to tomentulose; leaf blade drying papery, ovate-elliptic to elliptic, 3–5 × 1.5–3 cm, densely tomentulose to pilosulous on both surfaces, base cuneate then decurrent, usually slightly inequilateral, apex acute; secondary veins ca. 9 pairs; stipules caducous, triangular, 1.5–2 mm, puberulent to glabrescent, acute and sometimes erose. Inflorescences paniculate, many flowered, densely pilosulous to tomentulose; peduncles slender, 3.5–6.5 cm; axes distally scorpioid, 1–1.5 cm; bracts narrowly triangular, 0.3–0.8 mm. Flowers sessile or subsessile, distylous. Calyx densely puberulent to hispidulous; hypanthium portion ellipsoid to obconic, ca. 0.8 mm; lobes triangular, ca. 0.3 mm. Corolla white, tubular, outside puberulent to glabrescent; tube ca. 2 mm; lobes triangular, ca. 1 mm, dorsally keeled, apically rostrate-inflexed. Capsules subglobose to obovoid, ca. 2 mm, somewhat flattened laterally, valves 2 then tardily splitting into 4. Fl. Sep, fr. Dec.

• On limestone rocks and dripping cliffs. Guangdong (Yangchun).

**28. *Spiradiclis purpureocaerulea*** H. S. Lo, Bull. Bot. Res., Harbin 6(4): 39. 1986.

紫花螺序草 zi hua luo xu cao

Herbs, presumably perennial; stems densely brown pubescent. Leaves subsessile; blade drying papery, adaxially black, abaxially pale, ovate, 3–6.5 × 1.5–3 cm, adaxially densely strigose-hispidulous, abaxially densely pubescent, base rounded or obtuse, apex obtuse; secondary veins 7–10 pairs; stipules subulate, 2–3 mm, pubescent, caudate-acuminate. Inflorescence congested-cymose, 1.5–3 cm, densely pubescent; peduncles short. Calyx pubescent; hypanthium portion obconic-globose, ca. 2 mm; lobes narrowly lanceolate, 4–4.5 mm, acuminate. Corolla bluish purple, slenderly salverform; tube 19–21 mm; lobes sub-

ovate, ca. 6 mm, obtuse. Capsules subglobose, 4–4.5 mm in diam., pubescent, valves 4. Fl. Aug.

• On rocks at roadsides. Guangxi (Longzhou).

**29. *Spiradiclis rubescens*** H. S. Lo, Guihaia 11: 101. 1991.

红叶螺序草 hong ye luo xu cao

Herbs, apparently ascending, low, ca. 6 cm tall, perhaps annual; stems subglabrous, drying purplish black. Leaf blade drying papery, purplish red, elliptic-oblong or oblong-ovate, 4–6 × 2–2.3 cm, glabrous on both surfaces, base obtuse, margins ciliate, apex acute to obtuse; secondary veins 9–11 pairs; stipules triangular to broadly ovate, 4–5 mm, caudate-acuminate. Inflorescence cymose, 3–5-flowered; bracteoles linear, 4–6 mm, sparsely ciliate; pedicels short. Calyx glabrous; hypanthium portion obovoid, ca. 2 mm; lobes narrowly lanceolate, unequal, larger 4–4.5 mm, smaller ca. 3.5 mm, acuminate, ciliate, with gland in each sinus. Corolla red, slenderly salverform-funnel-form, outside glabrous, strongly 5-ribbed; tube ca. 21 mm; lobes ovate, ca. 3.5 mm. Capsules unknown. Fl. Jun.

• On rocks in shady places. Guangxi (Tiandong).

This species is noted for its reddened color when dry.

**30. *Spiradiclis scabrida*** D. Fang & D. H. Qin, Bull. Bot. Res., Harbin 13: 333. 1993.

糙边螺序草 cao bian luo xu cao

Herbs, perhaps perennial, 40–50 cm tall, rooting near base, apices apparently ascending; stems pubescent to glabrescent. Leaves often slightly anisophyllous; petiole 0.2–0.5 cm, glabrous or usually pubescent; blade drying papery, adaxially olive-green, abaxially yellowish green, ovate, narrowly ovate, or lanceolate, 2–9 × 1–3.3 cm, glabrous or occasionally sparsely strigillose or scabridulous at least on principal veins, base obtuse, apex acuminate; secondary veins 6–9 pairs; stipules caducous to persistent, subtriangular, 0.7–1 mm, subglabrous, acute. Inflorescence corymbose-cymose, 3–24-flowered, pubescent, puberulent, or glabrescent; peduncle 0.6–2.7 cm; bracteoles linear, 2–5 mm; pedicels to 2 mm. Flowers sessile to pedicellate. Calyx puberulent; hypanthium portion obovate, 1–1.5 mm; limb deeply lobed; lobes ovate-lanceolate, 1–1.5 mm, slightly unequal, with gland in each sinus. Corolla white sometimes flushed with pink or purple, slenderly salverform-funnel-form, glabrous inside and outside; tube 25–26 mm; lobes ovate, ca. 3.5 mm. Capsules subglobose, 3–4 mm in diam., glabrescent, valves 4. Fl. Dec, fr. Mar–Apr.

• On rocks in forests; 800–1200 m. Guangxi (Napo).

**31. *Spiradiclis spatulata*** X. X. Chen & C. C. Huang, Guihaia 13: 3. 1993.

匙叶螺序草 chi ye luo xu cao

Herbs, low, erect, perhaps perennial, usually reduced or acaulescent with leaves clustered at base. Petiole 5–8 mm; leaf blade drying papery, adaxially olive-green, abaxially pale, spatulate or obovate-oblanceolate, 8–13 × 2–4.5 cm, adaxially sparsely pubescent, abaxially densely pubescent at least along principal veins, base acute to cuneate and usually decurrent,

apex obtuse to rounded; secondary veins 15–25 pairs; stipules lanceolate-linear or linear, 7–9 mm, densely villosulous. Inflorescences cymose, 10- to many flowered, pubescent; peduncle 7–12 cm; bracteoles linear-lanceolate, 3–4 mm; pedicels 2–3 mm. Calyx pubescent; hypanthium obconic, 1.5–2 mm; limb deeply lobed; lobes narrowly lanceolate, 1–1.3 mm. Corolla purplish red, slenderly salverform, puberulent outside; tube 15–25 mm, inside with villous ring at middle; lobes subovate, 4–6 mm. Capsules unknown. Fl. May.

- On rocks in shady places. Guangxi (Ningming).

**32. *Spiradiclis tomentosa*** D. Fang & D. H. Qin, Bull. Bot. Res., Harbin 13: 330. 1993.

粘毛螺序草 nian mao lu xu cao

Herbs, erect, 3–23 cm tall, presumably perennial, acaulescent with leaves clustered at base; stems densely gray-viscid multicellular tomentose. Leaves slightly anisophyllous; petiole 0.5–4.5 cm, densely tomentose; blade drying thinly papery, oblanceolate, obovate, or rarely elliptic, 3.5–14 × 1.5–5 cm, both surfaces densely tomentose, base acute, apex cuspidate to rounded; secondary veins 7–10 pairs; stipules persistent, triangular, 8–22 mm, tomentose, narrowed to subulate acuminate apex. Inflorescences paniculiform, 8- to many flowered, tomentose; peduncles 4.5–18 cm; bracts linear, 3–7 mm; pedicels 1–5 mm. Calyx tomentose; hypanthium portion turbinate, ca. 1 mm; lobes linear, 1.5–2 mm. Corolla white, subfunnelform, outside sparsely pubescent; tube 6–8 mm, glabrous inside; lobes ovate, 2–3 mm. Capsules subglobose, ca. 2 mm in diam., valves 4, persistent calyx lobes 3.5–4 mm. Fl. Apr, fr. Jun.

- Limestone caverns; ca. 500 m. Guangxi (Fengshan).

H. S. Lo (in FRPS 71(1): 99. 1999) described the leaves as cuspidate at apex, but the corresponding figure (p. 103, t. 23, f. 7) showed the leaves to be apically rounded.

**33. *Spiradiclis umbelliformis*** H. S. Lo, Bull. Bot. Res., Harbin 6(4): 36. 1986.

伞花螺序草 san hua lu xu cao

Herbs, perhaps perennial, creeping or with upper parts perhaps ascending; stems densely reddish brown multicellular villosulous. Petiole 1–3 cm, reddish brown villosulous; leaf blade drying papery, adaxially olive-green, abaxially pale, ovate-orbicular, 1.5–4 × 1–3 cm, adaxially glabrescent, abaxially pilosulous to pilose at least along principal veins, base cordulate to truncate and usually decurrent, apex obtuse to rounded; secondary veins 4–6 pairs; stipules persistent, pilosulous to glabrescent, deeply 2-parted, lobes linear, to 10 mm. Inflorescences cymose, umbelliform to subcapitate, 4–10-flowered, puberulent, pilosulous, or villosulous; peduncles 2–7 cm; bracts narrowly triangular. Flowers subsessile, distylous. Calyx subgla-

brous; hypanthium portion turbinate to subglobose, ca. 1.5 mm; lobes ovate-triangular, ca. 0.6 mm, usually with gland in sinus. Corolla white to pale purplish red, funnelform to tubular-funnelform, glabrous outside; tube 17–18 mm, with villous ring above base inside; lobes ovate, ca. 6 mm. Capsules subglobose, 3–3.5 mm in diam., glabrescent, valves 4, flat. Fl. Apr.

- Rock crevices in forests, on limestone. Guangdong (Ruyuan), Guangxi.

**34. *Spiradiclis villosa*** X. X. Chen & W. L. Sha, Bull. Bot. Res., Harbin 11(3): 17. 1991.

毛螺序草 mao lu xu cao

Herbs, 30–50 cm tall, perennial, procumbent and rooting below, perhaps upper parts ascending; stems densely dark brown villous. Petiole 3.5–7 cm, densely villous; leaf blade drying membranous, oblong-elliptic or obovate-elliptic, 10–25 × 3–8 cm, adaxially dark brown pubescent, abaxially densely brown villous, base cuneate or acute, apex acute or shortly acuminate; secondary veins 14–16 pairs; stipules 2-lobed, densely dark brown villous, lobes lacinate, 15–30 mm. Inflorescences and flowers not seen. Infructescences cymose-paniculate, many flowered, densely dark brown villous; peduncles to 27 cm. Young capsules ovoid, ca. 2 mm, villous, with calyx lobes ca. 4 mm, dehiscence unknown. Young fr. Jul.

- On rocks in forests. Guangxi (Longzhou).

H. S. Lo (in FRPS 71(1): 101. 1999) described the stipules as to 30 mm, a relatively large size.

**35. *Spiradiclis xizangensis*** H. S. Lo, Bull. Bot. Res., Harbin 6(4): 43. 1986.

西藏螺序草 xi zang lu xu cao

Herbs, perhaps perennial, procumbent near base, ascending in upper parts; stems densely pubescent, drying purplish brown. Petiole 1–2 cm, densely pubescent; leaf blade drying thinly papery, leaden gray with veins dark purple abaxially, ovate, 3.5–6 × 1.5–3.2 cm, adaxially glabrescent except pubescent along midrib, abaxially pubescent along principal veins, base obtuse or subrounded, apex acute or slightly obtuse; secondary veins ca. 7 pairs; stipules sublanceolate, 2–2.5 mm, subglabrous, often reflexed. Inflorescence cymose, 4–6-flowered; peduncle ca. 1 cm; bracteoles linear-lanceolate, ca. 7 mm; pedicels 2–5 mm. Calyx densely pubescent; hypanthium portion subellipsoid, ca. 1.8 mm; lobes narrowly lanceolate, unequal, larger one ca. 2 mm, smaller ones ca. 1.6 mm. Corolla slenderly salverform-subfunnelform, outside pubescent; tube ca. 17 mm, glabrescent inside; lobes triangular, ca. 3 mm. Capsules unknown. Fl. May.

- Dense forests; 1800–2100 m. Xizang (Mêdog).

## 89. TARENNA Gaertner, Fruct. Sem. Pl. 1: 139. 1788.

乌口树属 wu kou shu shu

Chen Tao (陈涛); Charlotte M. Taylor

*Chomelia* Linnaeus (1758), not Jacquin (1760, nom. cons.); *Cupi* Adanson; *Webera* Schreber.

Shrubs or trees, unarmed, often drying blackened. Raphides absent. Leaves opposite, sometimes with domatia; stipules persis-

tent or occasionally tardily deciduous, interpetiolar or united around stem, triangular, often aristate. Inflorescences terminal, sometimes displaced to pseudoaxillary by subsequent growth, cymose to corymbiform, few to many flowered, sessile or pedunculate, bracteate or bracts reduced. Flowers pedicellate or sessile, bisexual, monomorphic, often fragrant. Calyx limb 5-lobed. Corolla white, pale green, or yellow, funnelform or salverform, inside glabrous or pubescent in throat; lobes 5, convolute in bud, usually strongly reflexed at anthesis. Stamens 5, inserted in corolla throat, exerted; filaments short or reduced; anthers dorsifixed. Ovary 2-celled, ovules 1 to numerous in each cell on axile placentas; stigma fusiform or linear, sulcate or striate, shortly 2-lobed at apex, exerted. Fruit baccate, leathery or thinly fleshy, globose to ellipsoid, black or perhaps sometimes white, with calyx limb deciduous; seeds several, medium-sized, plano-convex or concavo-concave, testa membranous, leathery, or crustaceous; endosperm fleshy or corneous; embryo small; cotyledon small, leaflike.

About 370 species: tropical and subtropical Africa, Asia, Madagascar, and Pacific islands; 18 species (12 endemic) in China.

The name *Chomelia* Linnaeus (1758) was applied to these plants for many years; however, the later homonym *Chomelia* Jacquin (1760), which applies to a wholly neotropical genus, is now conserved against the Linnaean name, so the Old World plants formerly known under *Chomelia* are now correctly known under *Tarenna*.

Most of the characters that distinguish species of *Tarenna* are found in the corollas and calyx limb, thus specimens of *Tarenna* are often difficult to identify when they only have fruit from which the calyx limb has fallen. The genus was not well known in China until the work of W. C. Chen (Acta Phytotax. Sin. 22: 139–174. 1984). *Tarenna* apparently has secondary pollen presentation. W. C. Chen (in FRPS 71(1): 370. 1999) described the stipules as caducous, but the specimens seen all have persistent or tardily deciduous stipules. The key here closely follows that of W. C. Chen in FRPS (loc. cit. 1999: 370–372), with its emphasis on pubescence characters and number of ovules per locule, for reference. Chen (loc. cit. 1999: 370–384) considered the form (i.e., raised vs. flat vs. impressed) of the leaf midrib adaxially to be consistent within a species, but specimens studied show variation within species and overlapping among most species.

- 1a. Flowers with pedicels 18–30 mm ..... 14. *T. sinica*
- 1b. Flowers subsessile or with pedicels to 13 mm.
  - 2a. Calyx lobes subulate, 3–5 mm ..... 7. *T. lanceolata*
  - 2b. Calyx lobes triangular to narrowly triangular, 2 mm or shorter.
    - 3a. Ovary with ovules 1 per cell; fruit with seeds 1 or 2 ..... 2. *T. attenuata*
    - 3b. Ovary with ovules 2 to many per cell; fruit with seeds 1 to many.
      - 4a. Corolla tube longer than corolla lobes.
        - 5a. Corolla villosulous to pilosulous outside; leaf blade densely villosulous to pilosulous ..... 17. *T. yunnanensis*
        - 5b. Corolla glabrous outside; leaf blade glabrous or sparsely puberulent, strigillose, or hirtellous abaxially.
          - 6a. Calyx lobes triangular-lanceolate, ca. 1.5 mm, strigillose; leaf blade abaxially glabrous or sparsely pilosulous or strigillose ..... 1. *T. acutispala*
          - 6b. Calyx lobes triangular to broadly triangular, 0.5–1.5 mm, glabrous; leaf blade abaxially glabrous or sparsely puberulent or strigillose.
            - 7a. Leaves with secondary veins 12–14 pairs ..... 5. *T. foonchewii*
            - 7b. Leaves with secondary veins 6–9 pairs.
              - 8a. Ovary with ovules 6–9 per cell; calyx with hypanthium portion sparsely puberulent to hispidulous, lobes 0.8–1.5 mm; leaf blade drying papery or membranous, with secondary veins 6 or 7 pairs ..... 3. *T. austrosinensis*
              - 8b. Ovary with ovules ca. 17 per cell; calyx with hypanthium portion glabrous, lobes 0.5–0.8 mm; leaf blade drying leathery, with secondary veins 7–9 pairs ..... 12. *T. polysperma*
  - 4b. Corolla tube as long as or shorter than corolla lobes.
    - 9a. Leaf blade glabrous on both surfaces.
      - 10a. Branches becoming yellowish white or grayish white with age, sometimes resinous at apex; stipules deciduous usually through fragmentation ..... 4. *T. depauperata*
      - 10b. Branches green to brown or ashy gray, not evidently resinous at apex; stipules persistent or deciduous through fragmentation.
        - 11a. Leaf secondary veins 3–10 pairs; petioles 0.8–2 cm; inflorescences 4–9 × 4–9 cm; leaf blade 4.5–15 × 1.5–6 cm.
          - 12a. Corolla tube 2–2.5 mm ..... 2. *T. attenuata*
          - 12b. Corolla tube 5–7 mm ..... 8. *T. lancilimba*
        - 11b. Leaf secondary veins 7–13 pairs; petioles 1–3.5 cm; inflorescences 4–15 × 6–20 cm; leaf blade 13–25 × 5–12 cm.
          - 13a. Leaf secondary veins 8–13 pairs; calyx mealy puberulent; inflorescences subglabrous or puberulent, ca. 15 × 20 cm; ovary with 4 ovules per cell ..... 9. *T. laticorymbosa*
          - 13b. Leaf secondary veins 7 or 8 pairs [or 6 in Japan]; calyx glabrous; inflorescences glabrous, 4–10 × 6–15 cm; ovary with 2 ovules per cell ..... 18. *T. zeylanica*
    - 9b. Leaves abaxially strigillose, hirtellous, hispidulous, pilosulous, or villosulous.

- 14a. Leaves pubescent adaxially, at least on midrib.  
 15a. Corolla glabrous outside; fruit with seeds 1–6 ..... 13. *T. pubinervis*  
 15b. Corolla strigillose or hirtellous outside; fruit with seeds ca. 30.  
 16a. Corolla tube 5–7 mm, lobes 11–12 mm, much longer than tube; leaf  
 secondary veins widely spaced, 6–8 pairs ..... 10. *T. laui*  
 16b. Corolla tube 3–4 mm, lobes 4–5 mm, slightly longer than or nearly as  
 long as tube; leaf secondary veins well spaced to closely set, 5–12 pairs ..... 11. *T. mollissima*
- 14b. Leaves glabrous or glabrescent adaxially.  
 17a. Corolla tube pubescent outside; leaf blade lanceolate or lanceolate-oblong,  
 12–29 × 4.5–10.5 cm, abaxially pubescent along principal veins ..... 16. *T. wangii*  
 17b. Corolla tube glabrous outside; leaf blade narrowly elliptic, obovate, lanceolate,  
 or oblong-obovate, 6–16 × 1.5–7 cm, abaxially subglabrous to scabrous,  
 puberulent, or strigillose on blade and veins.  
 18a. Ovary with ovules 5 or 6 per cell; pedicels rather slender, 5–10 mm; fruit  
 ellipsoid; leaf blade abaxially sparsely strigillose ..... 6. *T. gracilipes*  
 18b. Ovary with ovules 2 per cell; pedicels rather thick, 4–7 mm; fruit subglobose;  
 leaf blade scattered subpapillose-pubescent, scabrous, or subglabrous ..... 15. *T. tsangii*

**1. *Tarena acutisepala*** F. C. How ex W. C. Chen, Acta Phytotax. Sin. 24: 477. 1986.

尖萼乌口树 *jian e wu kou shu*

Shrubs, 1–2.5 m tall; branches hispidulous or hirtellous becoming glabrescent, gray to reddish brown. Petiole 5–22 mm, hispidulous; leaf blade drying papery or subleathery, elliptic-oblong, lanceolate, oblong-ovate, or subovate, 4–19.5 × 1.5–5.6 cm, adaxially glabrous or sometimes sparsely puberulent along midrib or sparsely strigillose throughout, abaxially strigillose to hirtellous or sometimes glabrous, base cuneate, obtuse, or acute, apex acuminate or acute; secondary veins 5–7 pairs; stipules persistent, shortly united around stem, triangular, narrowly triangular, or lanceolate, 4–7 mm, hispidulous to glabrescent, acute. Inflorescence corymbiform to congested-cymose, 2.5–3 × 3–4 cm, several to many flowered, strigillose, pedunculate; peduncle 0.5–1 cm; bracts lanceolate to triangular, 1.5–2 mm; pedicels 0.5–3 mm. Flowers subsessile to pedicellate. Calyx strigillose; hypanthium portion ellipsoid to ovoid, 1–1.5 mm; limb 1.5–2 mm, deeply lobed; lobes triangular-lanceolate, apex acute. Corolla pale yellow, glabrous outside; tube ca. 10 mm, villosulous inside upper part and throat; lobes narrowly elliptic, ca. 4 mm. Ovules 16–20 per cell. Berries subglobose, 5–7 mm in diam., strigillose or glabrous; seeds 9–31. Fl. Apr–Sep, fr. May–Nov.

• Forests or thickets at streamsides in valleys or on mountain slopes; 500–1600 m. Fujian, Guangdong, Guangxi, Hubei, Hunan, Jiangsu, Jiangxi, Sichuan.

**2. *Tarena attenuata*** (J. D. Hooker) Hutchinson in Sargent, Pl. Wilson. 3: 411. 1916.

假桂乌口树 *jia gui wu kou shu*

*Webera attenuata* J. D. Hooker, Fl. Brit. India 3: 104. 1880;  
*Ixora attenuata* (J. D. Hooker) Kuntze; *Tarena sylvestris* Hutchinson.

Shrubs or trees, 1–8 m tall; branches glabrous, flattened, becoming ash gray to brown with age. Petiole 0.5–1.5 cm, glabrous; leaf blade drying papery or thinly leathery, blackish brown, and somewhat shiny adaxially, oblong-lanceolate, ob-

long-obovate, lanceolate, or obovate, 4.5–15 × 1.5–6 cm, both surfaces glabrous, base cuneate or acute, margins sometimes thinly revolute, apex acuminate or abruptly shortly acuminate; secondary veins 5–10 pairs, sometimes with pilosulous domatia; stipules persistent, shortly united around stem, narrowly triangular, 4–9 mm, glabrous, acuminate to cuspidate. Inflorescences congested-cymose, pyramidal to corymbiform, 2.5–5 × 4–6 cm, many flowered, puberulent to glabrescent, pedunculate; peduncle 0.3–1 cm; bracts narrowly triangular to subulate, 1–5 mm, acute; pedicels 0.5–5 mm. Flowers subsessile to pedicellate in dichotomous cymules. Calyx glabrous; hypanthium portion subglobose to ellipsoid, 1.5–2 mm; limb 1–2 mm, lobed for 1/4–1/2; lobes triangular, acute. Corolla white or pale yellow, outside glabrous; tube 2–2.5 mm, villosulous at throat; lobes narrowly oblong to spatulate, 5–8 mm, acute to obtuse. Ovules 1 per cell. Berries subglobose, 5–7 mm in diam., glabrous; seeds 2. Fl. Apr–Nov, fr. May–Jan.

Forests or thickets at streamsides, on hills or mountains, or in fields; near sea level to 1200 m. Guangdong, Guangxi, Hainan, Yunnan [Cambodia, India, Thailand, Vietnam].

**3. *Tarena austrosinensis*** Chun & F. C. How ex W. C. Chen, Acta Phytotax. Sin. 22: 145. 1984.

华南乌口树 *hua nan wu kou shu*

Shrubs, ca. 2 m tall; branches terete to flattened, glabrous, becoming pale gray. Petiole 5–15 mm, glabrous; leaf blade drying papery or membranous, blackish brown, elliptic-oblong or oblong-lanceolate, 5–15 × 2–4.5 cm, glabrous on both surfaces or puberulent to strigillose abaxially, base cuneate to acute, apex acuminate; secondary veins 6 or 7 pairs, without domatia; stipules generally deciduous leaving truncate persistent base, ovate to triangular, 3–5 mm, glabrous, acuminate. Inflorescences corymbiform to cymose, ca. 3 cm, few flowered, strigillose; peduncle 4–5 mm; bracts linear to triangular, 1–3 mm, acute; pedicels 3–7 mm. Flowers pedicellate. Calyx with hypanthium portion cupular to ellipsoid, 1–1.5 mm, sparsely puberulent to hispidulous; limb 2–3 mm, glabrous, lobed for ca. 1/2; lobes triangular, apex acute. Corolla pale green, outside glabrous; tube ca. 7 mm, villosulous inside and at throat; lobes

ovate, 3–4 mm, apex acute. Ovules 6–9 per cell. Berries globose, 5–6 mm in diam.; seeds 6–14. Fl. Apr–May, fr. Aug–Sep.

• Forests on mountains; 800–1300 m. Guangdong (Xinyi), Guangxi (Jinxu), Hunan (Yizhang).

**4. *Tarenna depauperata*** Hutchinson in Sargent, Pl. Wilson. 3: 411. 1916.

白皮乌口树 bai pi wu kou shu

Shrubs or small trees, 1–6 m tall; branches glabrous, blackened becoming yellowish white or grayish white with age. Petiole 4–18 mm, glabrous; leaf blade drying papery or leathery, dark brown or sometimes yellowish brown abaxially, and somewhat shiny adaxially, elliptic-obovate, elliptic, or subovate, 4–15 × 2–6.5 cm, both surfaces glabrous, base cuneate or acute, apex shortly acuminate often abruptly acuminate with tip often slightly obtuse; secondary veins 5–11 pairs, without domatia; stipules deciduous usually through fragmentation, shortly united around stem, triangular-ovate, 1.5–3 mm, glabrous, resinous, acute. Inflorescences corymbiform to pyramidal, 2.5–3 × 3–5 cm, few to many flowered, puberulent, hirtellous, or glabrescent, subsessile to pedunculate; peduncle to 1 cm; bracts triangular, 0.3–1.5 mm; pedicels 0–3 mm. Flowers mixed sessile and pedicellate (or perhaps borne on expanded axes) in dichotomous cymules. Calyx glabrous, puberulent, or pilosulous; hypanthium portion cupuliform to ellipsoid, ca. 1 mm; limb ca. 1 mm, lobed for 1/2–3/4; lobes ovate or triangular, ciliate, acute to rounded. Corolla white, outside glabrous; tube 3–4 mm, villous inside and at throat; lobes narrowly oblong to spatulate, ca. 5 mm, acute to obtuse. Ovules 1–3 per cell. Berries globose, 6–8 mm in diam., shiny, glabrescent; seeds 1 or 2. Fl. Apr–Nov, fr. Apr–Jan.

Forests or thickets at streamsides, on hills, or on mountain slopes; 200–1700 m. Guangdong, Guangxi, Guizhou, Jiangsu, Yunnan [Vietnam].

**5. *Tarenna foonchewii*** (W. C. Ko) Tao Chen, **comb. nov.**

宽昭龙船花 kuan zhao long chuan hua

Basionym: *Ixora foonchewii* W. C. Ko, Guihaia 19: 102. 1999.

Small trees, to 3 m tall; branches glabrous. Petiole 12–17 mm, glabrous; leaf blade drying papery and olive-brown, elliptic, 15–18 × 5–9 cm, glabrous, base obtuse, apex cuspidate or shortly acuminate; secondary veins 12 or 13 pairs; stipules persistent, broadly triangular, 12–14 mm, glabrous, long acuminate to aristate. Inflorescence cymose, ca. 7 × 5.5 cm, many flowered; peduncle ca. 3 cm, sometimes subtended by or bearing reduced leaves or leaflike bracts; bracts linear, 3–4 mm; pedicels ca. 1 mm. Flowers pedicellate. Calyx glabrous; hypanthium cupuliform, ca. 2 mm; limb deeply lobed; lobes triangular, ca. 1 mm. Corolla outside glabrous; tube ca. 13 mm; lobes narrowly ligulate to narrowly elliptic, ca. 5 × 3 mm, obtuse. Fruit unknown. Fl. Apr.

• Roadsides. Yunnan.

Based on the description of this species as having 5 corolla lobes, fully exerted anthers, and subcapitate stigmas, as well as its general aspect, this species seems better placed in *Tarenna* than *Ixora*. The proto-

logue did not describe the number of ovules per ovary locule, which is not a significant character in *Ixora* and probably thus was not checked.

**6. *Tarenna gracilipes*** (Hayata) Ohwi, Repert. Spec. Nov. Regni Veg. 36: 57. 1934.

薄叶玉心花 bao ye yu xin hua

*Chomelia gracilipes* Hayata, Icon. Pl. Formosan. 9: 57. 1920; *C. lancifolia* Hayata; *Tarenna hayataiana* Kanehira; *T. lancifolia* (Hayata) Kanehira & Sasaki.

Shrubs, to 3 m tall; branches slender, strigillose becoming glabrescent and brown with age. Petiole 0.5–1.5 cm, strigillose; leaf blade drying papery, obovate, lanceolate, or narrowly elliptic, 6.5–15 × 2–4.5 cm, glabrous adaxially, sparsely strigillose abaxially at least along veins, base cuneate to acute, apex acute to acuminate; secondary veins 6 or 7 pairs, without domatia; stipules persistent, shortly united around stem, triangular, 1.5–3 mm, strigillose to glabrescent, acute to cuspidate. Inflorescences corymbose, 3–6 × 3–10 cm, trichotomous, strigillose, subsessile to pedunculate; peduncle to 1 cm; bracts narrowly triangular, 0.2–2 mm, acute; pedicels slender, 5–10 mm. Flowers pedicellate. Calyx glabrous to strigillose; hypanthium portion ellipsoid, 1–1.5 mm; limb 1–1.5 mm, lobed for 1/4–1/2; lobes broadly triangular, acute. Corolla white, glabrous outside; tube 4–6 mm, villous at throat; lobes narrowly spatulate-oblong, 9–10 mm, obtuse. Ovules 5 or 6 per cell. Berries ellipsoid, 5–8 mm in diam., glabrous. Fl. May, Jul, fr. Dec.

Forests on mountains; 100–500 m. Taiwan [Japan].

The specimens studied are from the elevations given; W. C. Chen (in FRPS 71(1): 378. 1999) gave the elevational range of this species as up to 2500 m.

**7. *Tarenna lanceolata*** Chun & F. C. How ex W. C. Chen, Acta Phytotax. Sin. 22: 139. 1984.

广西乌口树 guang xi wu kou shu

Shrubs, 0.5–3 m tall; branches densely strigillose becoming glabrescent, often brownish red. Petiole 0.3–1.8 cm, densely strigillose; leaf blade drying papery, lanceolate to oblanceolate, 5–32.5 × 1–5 cm, adaxially sparsely scabrous or strigillose on lamina and densely strigillose on principal veins, abaxially strigillose to pilosulous with pubescence denser on principal veins, base acute or cuneate, apex long acuminate; secondary veins 7–10 pairs, apparently without domatia; stipules generally persistent becoming brown and hardened, partially fused around stem, lanceolate to triangular or ovate, 3–4 mm, strigillose or glabrescent on margins, acute to cuspidate. Inflorescences corymbiform and often nodding, ca. 2 × 3 cm, several to many flowered, densely strigillose, sessile or pedunculate; peduncle to 5 mm; bracts linear to narrowly lanceolate, 2–10 mm; pedicels 1–3 mm. Flowers pedicellate. Calyx in bud with hypanthium portion ellipsoid to ovoid, 1.5–2 mm, densely pilosulous to puberulent; limb lobed nearly to base, densely strigillose; lobes linear to narrowly lanceolate, 3–5 mm, sometimes unequal on an individual flower. Corolla in bud densely strigillose outside. Berries subglobose, 3–6 mm in diam., puberulent, strigillose, or glabrescent; seeds 8–32. Fl. buds Oct, fr. May–Nov.

• Forests or thickets in valleys; 700–1600 m. Guangxi, Guizhou, Hunan (Dongkou).

W. C. Chen (in FRPS 71(1): 372. 1999) described the stipules as 6–10 mm, but the specimens studied (including several paratypes) all have stipules 3–4 mm.

**8. *Tarenna lancilimba*** W. C. Chen, Acta Phytotax. Sin. 22: 141. 1984.

披针叶乌口树 pi zhen ye wu kou shu

*Tarenna attenuata* (Voigt) Hutchinson var. *puberula* Chun & F. C. How ex W. C. Ko, Fl. Hainan. 3: 584. 1974.

Shrubs or trees, 2–10(–15) m tall; branches slightly compressed, glabrous or mealy pubescent, becoming brown with age. Petiole 0.8–2 cm, glabrous; leaf blade drying thinly leathery, dark brown or yellowish abaxially, lanceolate, elliptic, or obovate-oblong, 5–15 × 1.5–5 cm, both surfaces glabrous, base cuneate then shortly decurrent, apex shortly acuminate; secondary veins 3–5 pairs, without domatia; stipules generally persistent, shortly united around stem, triangular, 1.5–3 mm, glabrous, acute to cuspidate. Inflorescence corymbose, trichotomous, 4–9 × 4–9 cm, many flowered, subglabrous or mealy pubescent, subsessile; bracts triangular, 0.5–1.5 mm, ciliate; pedicels 3–6 mm. Flowers pedicellate. Calyx glabrous or puberulent; hypanthium portion cupuliform, 1–1.5 mm; limb 1–1.5 mm, lobed for ca. 1/2; lobes triangular to spatulate, ciliolate. Corolla white, outside glabrous, sparsely to densely villosulous at throat and onto lobes; tube 5–7 mm; lobes ligulate-linear, 5–6 mm, obtuse. Ovules 2 per cell. Berry globose, 5–6 mm in diam., glabrescent; seeds 2–4. Fl. Apr–Jun, fr. Jun–Jan.

Forests or thickets on hills; 100–1000 m. Guangxi (Shangsi), Hainan [Vietnam].

**9. *Tarenna laticorymbosa*** Chun & F. C. How ex W. C. Chen, Acta Phytotax. Sin. 22: 141. 1984.

宽序乌口树 kuan xu wu kou shu

Shrubs, height not noted; branches glabrous. Petiole 2.5–3.5 cm, glabrous; leaf blade drying membranous or papery and grayish black, elliptic-oblong or obovate-oblong, 18.5–25 × 6–10 cm, glabrous on both surfaces, base cuneate, apex acuminate or obtuse then mucronate; secondary veins 8–13 pairs; stipules ovate-triangular, glabrous. Inflorescence corymbose with axes spreading, ca. 15 × 20 cm, subglabrous or puberulent; pedicels 3–8 mm. Flowers pedicellate. Calyx mealy puberulent; hypanthium portion obconical; limb denticulate. Corolla glabrous outside, pilosulous in throat and onto bases of lobes; tube ca. 6.5 mm; lobes narrowly linear-oblong, ca. 7 mm, rounded. Ovules 4 per cell. Fruit unknown. Fl. May.

• Yunnan (Hekou).

**10. *Tarenna laui*** Merrill, Lingnan Sci. J. 14: 59. 1935.

崖州乌口树 ya zhou wu kou shu

Shrubs, 2–3 m tall; branches densely grayish yellow hispidulous or strigillose becoming glabrescent with age. Petiole 6–23 mm, densely strigillose; leaf blade drying papery and dark yellowish brown or blackish brown, oblong-elliptic or oblong-

lanceolate, 5–15 × 1.5–6 cm, sparsely hispidulous to strigillose adaxially, sparsely to densely hispidulous or strigillose abaxially, base cuneate or acute, apex acuminate; secondary veins 6–8 pairs; stipules generally persistent, shortly united around stem, broadly triangular, 1.5–3, densely strigillose, acute. Inflorescences cymose to corymbose and somewhat lax, 6–10 cm, densely grayish yellow strigillose, pedunculate; peduncle ca. 1 cm; bracts triangular, 1–3 mm; pedicels 2–13 mm. Flowers pedicellate. Calyx densely strigillose; hypanthium portion cylindrical, ellipsoid, or urceolate, 2–2.5 mm; limb 1–2 mm, lobed for ca. 1/2; lobes ovate-triangular to triangular, apex acute. Corolla white, outside densely strigillose; tube 5–7 mm, villous in throat; lobes narrowly lanceolate to spatulate, 11–12 mm, acute to obtuse. Ovules ca. 15 per cell. Berry subglobose, 5–6 mm in diam., strigillose. Fl. May–Jul, fr. Jul–Feb.

• Forests on mountains; ca. 700 m. Hainan (Sanya).

**11. *Tarenna mollissima*** (Hooker & Arnott) B. L. Robinson, Proc. Amer. Acad. Arts 45: 405. 1910.

白花苦灯笼 bai hua ku deng long

*Cupia mollissima* Hooker & Arnott, Bot. Beechey Voy. 192. 1833; *Mussaenda kuliangensis* F. P. Metcalf; *Stylocoryna mollissima* (Hooker & Arnott) Walpers; *Tarenna incana* Diels.

Shrubs or small trees, 1–6 m tall; branches densely gray or brown pilosulous or tomentulose, becoming glabrescent when old. Petiole 0.4–2.5 cm, densely pilosulous or tomentulose; leaf blade drying papery and blackish brown, lanceolate, oblong-lanceolate, or ovate-elliptic, 4.5–22.5 × 1–10 cm, adaxially moderately to densely hispidulous to pilosulous, abaxially densely pilosulous, tomentulose, or villosulous, base cuneate, acute, or obtuse, apex acuminate or long acuminate; secondary veins 5–12 pairs, apparently without domatia; stipules generally persistent, interpetiolar or shortly united around stem, ovate to triangular, 5–8 mm, densely strigillose to pilosulous, acute to cuspidate. Inflorescences corymbose, 4–8 cm, many flowered, densely pilosulous to tomentulose, sessile and subtended by a pair of somewhat reduced leaves; bracts linear, 1–3 mm; pedicels 3–6 mm. Flowers pedicellate. Calyx densely tomentulose to pilosulous; hypanthium portion ellipsoid to subglobose, 1.5–2 mm; limb 1–1.8 mm, lobed shallowly to deeply; lobes triangular to spatulate, rounded to acute. Corolla white, outside densely strigillose to hirtellous; tube 3–4 mm, densely villous at throat; lobes narrowly oblong, 4–5 mm, obtuse to rounded. Ovules ca. 15 per cell. Berry subglobose, 5–7 mm in diam., pilosulous, villosulous, or sometimes glabrescent; seeds 7–30. Fl. May–Jul, fr. May–Jan.

Forests or thickets at streamsides, on hills, or on mountains; 200–1100 m. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hunan, Jiangxi, Yunnan, Zhejiang [Vietnam].

W. C. Chen (in FRPS 71(1): 377. 1999) described the corollas as ca. 1.2 cm, but this length has not been seen on the numerous specimens studied.

**12. *Tarenna polysperma*** Chun & F. C. How ex W. C. Chen, Acta Phytotax. Sin. 22: 144. 1984.

多籽乌口树 duo zi wu kou shu

Shrubs or trees, 1.5–14 m tall; branches slightly compressed, glabrous, becoming brown when old. Petiole 5–15 mm, glabrous; leaf blade drying leathery and olive-greenish brown, oblong-lanceolate or elliptic, 5–10.5 × 1.5–3.8 cm, glabrous on both surfaces, base cuneate, apex shortly acuminate or abruptly acute; secondary veins 7–9 pairs, without domatia; stipules deciduous usually through fragmentation often leaving a persistent truncate base, interpetiolar, triangular to narrowly triangular, 3–4 mm, glabrous, acute. Inflorescences corymbose and trichotomous, 3–5 × 4–6 cm, 6–10-flowered, puberulent to glabrescent, subsessile to pedunculate; peduncle to 1 cm; bracts filiform, 1–2 mm, ciliolate; pedicel 3.5–6.5 mm. Flowers pedicellate. Calyx glabrous; hypanthium portion turbinate, ca. 1 mm; limb 1–1.5 mm, lobed for ca. 1/2; lobes broadly triangular. Corolla white, glabrous outside; tube ca. 8 mm, villous at throat; lobes ovate to elliptic, ca. 4.5 mm, obtuse. Ovules ca. 17 per cell. Berry globose, ca. 7 mm in diam., glabrous; seeds 14–27. Fl. Mar–Apr, fr. May–Oct.

- Forests on mountains; 900–1000 m. Guangdong.

The protologue and W. C. Chen in FRPS (71(1): 382. 1999) described the secondary leaf veins as 7–9 pairs, but the paratypes seen all have 5 or 6 pairs, which has complicated herbarium identifications of this species.

**13. *Tarenna pubinervis*** Hutchinson in Sargent, Pl. Wilson. 3: 411. 1916.

滇南乌口树 dian nan wu kou shu

Shrubs or small trees, 0.5–6 m tall; branches puberulent to pilosulous, becoming gray with age. Petiole 5–25 mm, strigillose to hirtellous; leaf blade drying papery or membranous, blackish brown, oblong-elliptic, oblong-lanceolate, lanceolate, or oblanceolate, 6–22 × 2–7.8 cm, strigillose to hirtellous on both surfaces with pubescence denser on principal veins, base acute to attenuate, apex caudate-acuminate or acuminate; secondary veins 7–10 pairs, apparently without domatia; stipules generally persistent and becoming yellowed and hardened, interpetiolar or shortly united around stem, triangular to ovate, 3–9 mm, pilosulous to strigillose becoming glabrescent, long acuminate to aristate or cuspidate. Inflorescences cymose, ca. 3 × 3.5 cm, few flowered, densely strigillose, subsessile; bracts linear, 1.5–2 mm; pedicels 1–2.5 mm. Flowers pedicellate. Calyx glabrous or sparsely pubescent; hypanthium portion obconic, 1–1.5 mm; limb lobed for ca. 1/2; lobes lanceolate, 1–1.75 mm, ciliate. Corolla pale green, glabrous outside; tube 4–5 mm, villosulous inside; lobes narrowly oblong, 5–6 mm, obtuse. Ovules ca. 3 per cell. Berry subglobose to ellipsoid, 5–10 mm in diam., puberulent to glabrescent; seeds 1–6. Fl. Mar–May, fr. Jun–Jan.

- Forests in valleys; 700–2700 m. Guangxi, Sichuan, Yunnan.

**14. *Tarenna sinica*** W. C. Chen, Acta Phytotax. Sin. 22: 146. 1984.

长梗乌口树 chang geng wu kou shu

Shrubs, ca. 1.5 m tall; branches hispid. Petiole 0.5–1.5 cm, hispid; leaf blade drying papery and blackish brown, narrowly elliptic or elliptic-lanceolate, 6–12 × 2–4 cm, both surfaces

sparsely strigose except densely hispid-hirsute along principal lateral veins, base cuneate, apex acuminate; secondary veins 6–8 pairs; stipules persistent becoming hardened and straw-yellow, subtriangular, ca. 2 mm, hispidulous, acute. Inflorescences corymbiform, ca. 5 cm, few flowered, hispidulous, pedunculate; peduncle 0.5–0.7 cm; bracts lanceolate, ca. 2 mm; pedicels 18–30 mm. Flowers pedicellate. Calyx hispidulous; hypanthium portion ellipsoid, ca. 1.5 mm; limb lobed for ca. 1/2; lobes triangular, ca. 0.7 mm, acute. Corolla white, ca. 12 mm, hispidulous outside; tube densely villosulous inside and at throat; lobes linear-lanceolate, longer than corolla tube. Ovules 1 per cell. Berry unknown. Fl. Jun.

- Forests on mountain slopes. Guangxi (Jingxi).

**15. *Tarenna tsangii*** Merrill, Lingnan Sci. J. 11: 59. 1932.

海南乌口树 hai nan wu kou shu

*Tarenna tsangii* f. *elliptica* Chun & F. C. How ex W. C. Ko.

Shrubs or trees, 1–6 m tall; branches flattened, shortly pilosulous, becoming brown or grayish brown with age. Petiole 5–15 mm, pilosulous; leaf blade drying papery and blackish brown, oblong-obovate or lanceolate, 5–26 × 1.5–7 cm, adaxially glabrous, abaxially scabrous and sparsely puberulent to subglabrous with pubescence denser along principal veins, base cuneate, apex acuminate or shortly acuminate; secondary veins 4–7 pairs; stipules triangular, 4–5 mm, acuminate or apiculate. Inflorescence corymbose, 4–7 × ca. 6 cm, many flowered, gray strigillose, pedunculate; pedicels 4–7 mm. Flowers pedicellate. Calyx pilosulous; hypanthium portion cylindrical-urceolate, ca. 1.5 mm; limb ca. 1.5 mm, lobed for up to 1/3. Corolla white, glabrous outside; tube 8–9 mm, pilosulous inside; lobes narrowly oblong, ca. 10 mm. Ovary with 2 ovules per cell. Berry subglobose, 5–7 mm in diam., glabrous; seeds 4. Fl. May–Jul, fr. Jul–Jan.

- Forests on hills; 100–800 m. Guangdong (Maoming), S Guangxi, Hainan.

Plants from Hainan (Lingshui) with leaf blade elliptic or ovate-elliptic and 5–8 × 3–6 cm that fruit in Dec were described as *Tarenna tsangii* f. *elliptica*. These features, however, do not clearly distinguish the two groups of plants in Hainan, so this name is here synonymized.

**16. *Tarenna wangii*** Chun & F. C. How ex W. C. Chen, Acta Phytotax. Sin. 22: 143. 1984.

长叶乌口树 chang ye wu kou shu

Shrubs, 2–5 m tall; branches gray, glabrous. Petiole 1–3 cm, subglabrous or puberulent; leaf blade drying papery or membranous and brownish black, lanceolate or lanceolate-oblong, 12–29 × 4.5–10.5 cm, glabrous on both surfaces or abaxially strigillose along principal veins, base attenuate, apex acuminate or shortly acuminate; secondary veins 9–11 pairs; stipules ovate-triangular, 3–4 mm. Inflorescences corymbose, ca. 5 × 5 cm, strigillose; pedicels 3–4 mm. Flowers pedicellate. Calyx pilosulous; hypanthium portion obconical; limb subtruncate or denticulate. Corolla white, villous inside and onto lobes; tube ca. 5 mm; lobes linear-oblong. Ovules 4 per cell. Berry subglobose, 8–10 mm in diam.; seeds 2 or 3. Fl. Jun, fr. Aug–Nov.

- Forests on hills; 900–1000 m. Yunnan.

**17. *Tarenna yunnanensis*** F. C. How ex W. C. Chen, Acta Phytotax. Sin. 22: 142. 1984.

云南乌口树 *yun nan wu kou shu*

Shrubs or trees, to 3 m tall; branches densely yellowish brown villosulous to tomentulose. Petiole 0.5–2.3 cm, densely villosulous to tomentulose; leaf blade drying papery, elliptic, obovate, elliptic-oblong, or oblanceolate-oblong, 11–32 × 3.5–12 cm, adaxially subglabrous or sparsely hispidulous with pubescence denser along principal veins, abaxially densely villosulous to pilosulous, base cuneate, obtuse, or acute, apex abruptly shortly acuminate; secondary veins 8–12 pairs, apparently without domatia; stipules generally persistent, shortly united around stem, broadly triangular, 2.5–4 mm, densely villosulous, acute to cuspidate. Inflorescences cymose to corymbiform, 4–9 × 4–7 cm, many flowered, densely pilosulous, pedunculate; peduncle 1–3.5 cm; bracts linear to narrowly triangular, 1–4 mm; pedicels 2–9 mm. Flowers pedicellate. Calyx densely pilosulous; hypanthium portion cupulate, ca. 1 mm; limb 1–1.5 mm, lobed shallowly or for up to 1/2; lobes triangular. Corolla outside moderately to densely yellowish brown villosulous to pilosulous; tube 5–6.5 mm, sparsely pilosulous at throat; lobes narrowly oblong to spatulate, 4–4.5 mm, obtuse. Ovules 3–5 per cell. Berry subglobose, ca. 5 mm in diam., yellowish brown villous. Fl. Apr–Jun, fr. Jun.

- Forests or thickets in valleys or at streambanks; 100–200 m. Yunnan.

**18. *Tarenna zeylanica*** Gaertner, Fruct. Sem. Pl. 1: 139. 1788.

锡兰玉心花 *xi lan yu xin hua*

*Chomelia kotoensis* Hayata; *Tarenna kotoensis* (Hayata) Masamune.

Shrubs, evergreen, to 2.5 m tall; branches glabrous, compressed to subquadrangular, green sometimes turning brown. Petiole 1–2.5 cm, glabrous; leaf blade drying papery, oblong-ovate to oblong-obovate, elliptic, or elliptic-oblong, 13–22 × 5–12 cm, glabrous on both surfaces, base cuneate to obtuse, apex shortly cuspidate or acute; secondary veins 7 or 8 pairs, with pilosulous domatia; stipules generally deciduous through fragmentation often leaving persistent base, shortly united around stem, triangular, 3–11 mm, glabrous, acute to acuminate. Inflorescences corymbiform to broadly pyramidal, 4–10 × 6–15 cm, many flowered, glabrous, subsessile to pedunculate; peduncle to 1 cm; bracts linear to narrowly triangular, 1–3 mm, acute; pedicels 3–8 mm. Flowers pedicellate. Calyx glabrous; hypanthium portion ellipsoid to cupular, 1–1.5 mm; limb 1–1.5 mm, lobed for ca. 1/2; lobes triangular. Corolla white, glabrous outside; tube ca. 5 mm, villous in throat; lobes narrowly oblong to spatulate, 7–12 mm, obtuse. Ovules 2 per cell. Berry globose, ca. 10 mm in diam., glabrous; seeds 2–4. Fl. Feb, Apr, fr. Sep, Dec.

Forests; below 100–600 m. Taiwan [Japan, Sri Lanka].

W. C. Chen (in FRPS 71(1): 373. 1999) described the petioles as up to 5 cm, but no petioles at all similar to this have been seen on specimens studied.

## 90. TARENNOIDEA Tirvengadam & Sastre, Mauritius Inst. Bull. 8(4): 90. 1979.

岭罗脉属 *ling luo mai shu*

Chen Tao (陈涛); Charlotte M. Taylor

Trees, unarmed. Raphides absent. Leaves opposite, usually with domatia; stipules caducous, interpetiolar or shortly united around stem, triangular to ovate. Inflorescences terminal or sometimes pseudoaxillary or appearing leaf-opposed due to anisophyly with 1 leaf caducous at subtending node, compound-cymose, several to many flowered, pedunculate or sessile and tripartite, bracteate. Flowers pedicellate, bisexual, monomorphic. Calyx limb campanulate, truncate to 5-dentate. Corolla yellow to white, salverform, inside villosulous in throat; lobes 5, convolute in bud, reflexed at anthesis. Stamens 5, inserted in corolla throat, exerted; filaments short; anthers dorsifixed. Ovary 2-celled, ovules 1 or usually 2–6 in each cell on axile placentas; stigma fusiform to cylindrical, exerted. Fruit black, baccate, subglobose, leathery or fleshy, with calyx limb deciduous; seeds 2–8, medium-sized, ellipsoid to subglobose.

Two species: S and SE Asia; one species in China.

**1. *Tarennoidea wallichii*** (J. D. Hooker) Tirvengadam & Sastre, Mauritius Inst. Bull. 8(4): 90. 1979.

岭罗麦 *ling luo mai*

*Randia wallichii* J. D. Hooker, Fl. Brit. India 3: 113. 1880; *Aidia wallichii* (J. D. Hooker) T. Yamazaki; *Tarenna incerta* Koorders & Valetton; *T. pallida* (Franchet ex Brandis) Hutchinson; *Webera cavalieriei* H. Léveillé; *W. pallida* Franchet ex Brandis.

Trees, 3–20 m tall; branches rather stout, compressed to angled, glabrous, with thin epidermis wrinkled and cracked, coppery brown to reddish purple-brown, deciduous leaving

stems wrinkled to smooth. Petiole 1–3 cm, glabrous; leaf blade drying leathery and often paler below, elliptic-oblong, oblanceolate-oblong, or elliptic-lanceolate, 7–30 × 2.9–9 cm, adaxially shiny and glabrous, abaxially puberulent to glabrous, base cuneate to acute, margins often thinly revolute, apex obtuse to acuminate with tip often ultimately obtuse; secondary veins 5–13 pairs, in abaxial axils with foveolate and/or pilosulous domatia; stipules 4–10 mm, glabrous, acute to acuminate. Inflorescences 4–12 × 8–13 cm, densely hirtellous or pilosulous to tomentulose; bracts lanceolate to spatulate, 1–3 mm, acute to rounded; pedicels 1–5 mm. Calyx with ovary portion obconic, ca. 1 mm, densely puberulent to tomentulose; limb 1–2.5 mm, puberulent or tomentulose to glabrescent, with lobes linear to

narrowly triangular, 0.5–0.7 mm, acute. Corolla yellow or white, outside glabrous [to sericeous], inside pilosulous in throat with pubescence sometimes extending onto lobes; tube 3–4 × ca. 1.5 mm; lobes spatulate-oblong, 3–4 mm, obtuse to rounded. Fruiting pedicels to 10 mm. Berry ovoid to subglobose, 7–18 mm in diam., glabrous; seeds ca. 5 mm. Fl. Mar–Jun, fr. Jul–Feb.

Forests or thickets at streamsides in valleys or on hills or mountains; 400–2200 m. Guangdong, Guangxi, Guizhou, Hainan, Yunnan

[Bangladesh, Bhutan, Cambodia, India, Indonesia, Malaysia, Myanmar, Nepal, Philippines, Thailand, Vietnam].

Puff et al. (Rubiaceae of Thailand, 70. 2005) noted that the growth form or architecture of this species is strongly sympodial: “approached a Terminalian branching pattern.” The flowers on our specimens appear to be strongly dichogamous, with the anthers fully developed and apparently dehiscent while the stigmas are still enclosed in the corolla tube; then after the anthers have released all their pollen the styles apparently elongate and the stigmas become fully exerted from the corolla.

## 91. THELIGONUM Linnaeus, Sp. Pl. 2: 993. 1753.

假繁缕属 *jia fan lü shu*

Chen Jiarui (陈家瑞 Chen Chia-jui); A. Michele Funston

*Cynocrambe* Gagnebin.

Herbs, annual or perennial, monoecious. Stems somewhat succulent. Raphides present. Leaves petiolate, somewhat succulent, lower ones opposite, upper ones apparently alternate due to anisophylly, entire; stipules interpetiolar, membranous, united at base to petioles. Flowers unisexual, rarely bisexual, axillary in upper nodes, small 1–3 flowered cymes, bracts reduced. Staminate flowers sessile; calyx limb reduced; perianth (equivalent to corolla) deeply lobed, lobes 2–5, valvate, spreading or reflexed at anthesis, 3–5 parallel nerves; stamens (2–)6–30, sometimes united basally in groups, anthers linear, dorsifixed at anthesis, free slender filaments, pistillode reduced. Pistillate flowers subsessile; calyx limb reduced; perianth (equivalent to corolla) tubular, oblique, upper part an elongate constricted mouth, 2–4 denticulate-lobed; staminodes reduced; ovary 1-celled; style simple, exerted; ovule solitary, basal. Fruit a nutlike drupe, compressed; seed U-shaped; endosperm fleshy.

Four species: E Asia, Atlantic Ocean islands, Mediterranean region; three species (two endemic) in China.

Traditionally, Theligonaceae have been treated as a monogeneric family of controversial relationship: Rubiales (Cronquist), Myrtales (Engler), Caryophyllales (Dalla Torre & Harms). However, recent reliable molecular data place it within a highly derived group of Rubiaceae (along with *Galium*, *Hedyotis*, and *Rubia*; Pl. Syst. Evol. 225: 43–75. 2000).

- 1a. Stamens 5–7; stem often ca. 10 cm ..... 1. *T. formosanum*  
 1b. Stamens ca. 20; stem 15–50 cm.  
 2a. Annual herbs; leaf blades 2–5 × 1.5–3 cm; stamens more than 20 ..... 3. *T. macranthum*  
 2b. Perennial herbs; leaf blades 0.7–3 × 0.7–1.5 cm; stamens 20–25 or 16–20 ..... 2. *T. japonicum*

**1. *Theligonum formosanum*** (Ohwi) Ohwi & T. S. Liu, Fl. Taiwan 3: 904. 1977.

台湾假繁缕 *tai wan jia fan lü*

*Cynocrambe formosana* Ohwi, Acta Phytotax. Geobot. 2: 157. 1933.

Herbs, perennial, small, becoming black when dry. Stem erect, 10–15 cm, branched from base, creeping below, somewhat hairy. Leaf blade broadly ovate, 1.2–2 × 1–1.5 cm, pilose adaxially, puberulent on veins abaxially, base subcordate, subtruncate, or rounded, decurrent to petiole, apex acute; petiole 0.5–1.2 cm; stipules membranous, connate, deltoid-ovate, 2–3 mm, ciliate. Flowers white, unisexual. Staminate flowers: perianth membranous, 3-parted, lobes oblanceolate, 2.5–3 mm, obtuse, reflexed, 3–5-veined; stamens 5–7. Pistillate flowers smaller; perianth 2-lobed, lobes obtuse. Fruit obliquely obovoid, ca. 4 mm, hairy. Fl. Mar–Jul, fr. Jun–Aug.

• Wet places in forests and along mountain trails; ca. 2700 m. Taiwan (Pingdong).

**2. *Theligonum japonicum*** Ôkubo & Makino, Bot. Mag. (Tokyo) 3: 五 [5]. 1889.

日本假繁缕 *ri ben jia fan lü*

*Cynocrambe japonica* (Ôkubo & Makino) Makino.

Herbs, perennial, fetid. Stem erect or ascending, 15–36 cm, branched often from base, creeping below, pubescent above. Leaf blade ovate or elliptic, 0.7–3 × 1–1.5 cm, pubescent on both surfaces, base rounded or broadly cuneate, apex acute, lateral veins 3 each side; petiole 0.3–1.5 cm; stipules membranous, connate, ovate or deltoid-ovate, 2–3 mm, ciliate. Flowers unisexual. Staminate flowers: perianth membranous, 3-parted, lobes oblanceolate, 2.5–3 mm, obtuse, reflexed, 3–5-veined; stamens 20–25 or 16–20, pendulous. Pistillate flowers: minute; perianth 3- or 4-toothed. Fruit obliquely ovoid, ca. 5 mm, hairy. Fl. Mar–Jun, fr. Jun–Aug.

Wet places in valleys, by streams; 900–1200 m. Anhui, Shaanxi, Zhejiang [Japan].

**3. *Theligonum macranthum*** Franchet, Nouv. Arch. Mus. Hist. Nat., sér. 2, 10: 71. 1887.

假繁缕 *jia fan lü*

*Cynocrambe macrantha* (Franchet) Poulsen.

Herbs, annual, fetid. Stem erect, 30–50 cm, ferruginous pubescent. Leaves herbaceous; leaf blade broadly ovate, ovate-lanceolate, or suboblong, 2–5 × 1–3 cm, sparsely pubescent on both surfaces, glabrescent, base subcuneate or subrounded, somewhat decurrent to petiole, apex acuminate; petiole 0.5–

1.8 cm; stipules membranous, connate, ovate or deltoid-ovate, 4–6 mm, ciliate. Flowers unisexual. Staminate flowers: perianth membranous, 2-lobed, tube ca. 2 mm, lobes 3–5 mm, lanceolate, apex obtuse, reflexed, 5–7-veined; stamens more than 20.

Pistillate flowers: smaller; perianth 2-lobed, apex obtuse. Fruit ovoid, ca. 5 mm. Fl. Apr–Jul, fr. Jun–Aug.

• Wet places in forests; 1800–2400 m. W Hubei, Sichuan, Zhejiang.

## 92. TIMONIUS Candolle, Prodr. 4: 461. 1830, nom. cons.

海茜树属 hai qian shu shu

Chen Tao (陈涛); Charlotte M. Taylor

Trees or shrubs, dioecious [or sometimes polygamo-dioecious], unarmed, terrestrial [or sometimes epiphytic]. Raphides absent. Leaves opposite or verticillate, usually with domatia, notably leathery [to papery or succulent]; tertiary venation finely lineolate [or sometimes not visible]; stipules caducous, interpetiolar [or calyprate], triangular. Inflorescences axillary, cymose with axes dichotomous to scorpioid, few to several flowered with pistillate usually fewer flowered than staminate, pedunculate, bracteate or bracts reduced; bracteoles sometimes fused in pairs. Flowers sessile, unisexual. Calyx limb cupular, truncate to 4- or 5-lobed. Corolla white to pale yellow, funnellform or tubular-funnelform with pistillate frequently shorter and broader in diam. than staminate, outside densely strigose to sericeous, inside glabrous, leathery; lobes 4(–10), thinly imbricate in bud (i.e., “subimbricate” of Darwin 1993, with margins thinly overlapping; see comment below). Stamens 4(–10), inserted in corolla throat, exserted; filaments short; anthers dorsifixed, at base 2-lobed. Ovary many celled, ovules 1 in each cell, pendulous from apical placentas; disk hirsute; style 4–12-parted with segments linear, often unequal; stigmas 4–12 (i.e., 1 on each style arm), papillose, included or exserted. Fruit red or black, drupaceous, thinly fleshy, ovoid, subglobose, or oblate (i.e., depressed globose), often 4- or 5-ridged when dry, with calyx limb persistent; pyrenes several to numerous [to 350 or more], 1-celled with 1 seed, narrowly oblong to cylindrical, bony; seeds cylindrical, straight or curved; testa membranous; endosperm scanty or absent; embryo straight or curved; cotyledons minute, flattened; radicle elongate, terete, ascending.

About 150–180 species: tropical SE Asia and the Pacific islands; one species in China.

Darwin (Allertonia 7(1): 1–39. 1993) noted that although the corolla lobes have been commonly described as valvate in *Timonius*, in fact, they are “subimbricate” with the margins only thinly overlapping; this arrangement is here called “thinly imbricate.” A notable characteristic of *Timonius* within the Rubiaceae is the multiplication of ovules, or often entire files of ovules, as well as the number of cells in the ovary, from the 2 cells that are typical of most Rubiaceae, to far past the 5–9 cells found in *Guettarda*. Darwin (loc. cit.; Syst. Bot. Monogr. 42: 1–86. 1994) has monographed part but far from all of this large genus.

**1. *Timonius arboreus*** Elmer, Leaf. Philipp. Bot. 1: 72. 1906 [“*arborea*”].

海茜树 hai qian shu

Trees 5–12 m tall; branches angled or flattened, rather stout, glabrous or glabrescent, often markedly sylleptic from nodes below leaves with markedly elongated lowermost internode, with scars of petioles often enlarged. Leaves opposite or usually whorls of 3; petiole stout, 1–5 mm, glabrous; blade drying stiffly papery, elliptic, elliptic-oblong, or broadly elliptic, 8.4–17 × 3–7.5 cm, adaxially glabrous, abaxially moderately to sparsely strigillose, base cuneate to acute and often tapered, apex acuminate; secondary veins 5–7 pairs, usually with densely pilosulous domatia; stipules caducous often leaving a ring of persistent trichomes 0.5–1 mm, triangular to lanceolate, 5–7 mm, abaxially moderately strigose, adaxially densely sericeous, acute to acuminate. Inflorescences strigose to glabrous, stami-

nate 3–7-flowered, pistillate 1-flowered; peduncles 0.5–3 cm; bracts lanceolate to triangular, 0.5–2 mm, usually fused in pairs. Flowers subtended at immediate base by 2 to several persistent bracteoles 0.5–1 mm, these sometimes shortly fused in pairs. Calyx sparsely strigillose to glabrous; ovary portion subglobose, 2.5–3.5 mm in diam.; limb tubular, 1–2 mm, truncate or undulate to 5- or 6-denticulate. Corolla outside densely velutinous-strigillose to sericeous; tube 4–7 mm, glabrous inside; lobes 6–8, narrowly triangular, 4–7 mm, acute. Drupes subglobose to oblate, 8–10 × 10–14 mm, glabrescent, color not noted; pyrenes 50 or more, subcylindrical, 6–7 × 2–2.5 mm. Fl. Apr, Nov, fr. Apr–Jun.

Near sea level to 400 m. Taiwan [Philippines].

The pubescence of the lower leaf surface is nearly colorless and arranged along the higher order veins; thus, it is often difficult to see, even with good magnification, and has been overlooked by some authors.

## 93. TRAILLIAEDOXA W. W. Smith & Forrest, Notes Roy. Bot. Gard. Edinburgh 10: 74. 1917.

丁茜属 ding qian shu

Chen Tao (陈涛); Charlotte M. Taylor

Shrubs, low, erect, unarmed or with spinescent branches; branches at base with a pair of reduced, usually deciduous leaves and a persistent stipule. Raphides apparently absent. Leaves opposite, sometimes fasciculate on unexpanded axillary stems and appearing whorled, subsessile, without domatia; stipules deciduous, interpetiolar or fused to petiole bases, 2-lobed, lobes gland-tipped. Inflorescences terminal, pseudoaxillary, or terminal on paired lateral short shoots and appearing axillary, congested-cymose to umbelliform or fasciculate, few to many flowered, often nodding, sessile to pedunculate; bracts reduced or occasionally leaflike. Flowers pedi-

cellate, bisexual, apparently monomorphic. Calyx limb 5-lobed essentially to base. Corolla white, pink, or pale yellow, salverform to funnellform, glabrous inside; lobes 5, convolute in bud. Stamens 5, inserted in corolla throat, exserted; filaments short; anthers dorsifixed near base. Ovary 2-celled, ovules 1 in each cell, pendulous from apex; style curved; stigma clavate to ellipsoid and 2-lobed for a third to half its length, exserted. Fruit schizocarpous, dry, oblanceoloid, with calyx limb persistent; mericarps 2, indehiscent, each with 1 seed, ellipsoid, crustaceous; seeds medium-sized, ellipsoid; testa leathery; endosperm absent; embryo linear-oblanceolate.

- One species: China.

The presence or absence of raphides has not been specifically noted anywhere we have seen; their absence is presumed here based on observations of specimens and the classification by Robbrecht (*Opera Bot. Belg.* 1: 1–271. 1988) of this genus in Antirrhoideae. W. C. Ko (in FRPS 71(2): 1. 1999) described the anthers as partially exserted, but these are fully exserted at anthesis on the specimens studied. On the few specimens studied (*T. T. Yü 1348*, *C. Schneider 2194*, *Forrest 10713*, all A; *Boufford et al. 35041*, MO), the flowers appear to be protandrous, with the stamens apparently dehiscing while the stigmas are enclosed in the corolla; on these plants subsequently the style elongates, the stigma is exserted by several millimeters, and then the two lobes separate and presumably become receptive.

**1. *Trailliaedoxa gracilis*** W. W. Smith & Forrest, *Notes Roy. Bot. Gard. Edinburgh* 10: 75. 1917.

丁茜 *ding qian*

Subshrubs, erect, 20–45(–60) cm tall, multibranched; branchlets weakly angled to terete, densely strigillose to pilosulous becoming glabrescent. Leaf blade drying papery to stiffly papery, obovate, elliptic, or oblanceolate, 0.5–1 × 0.3–0.4 cm, adaxially glabrous or sparsely pilosulous to strigillose, abaxially paler and glabrous or villosulous to strigillose or hispidulous at least along midrib, base acute or very shortly and abruptly truncate, apex rounded or obtuse; secondary veins indistinct; stip-

ules 0.6–1 mm, pilosulous to glabrescent. Inflorescences 0.5–1 × 0.8–1 cm, 6–12-flowered, pilosulous to villosulous, sessile or with peduncle to 5 mm; pedicels 1–2 mm. Calyx with ovary portion cylindrical-lanceoloid, ca. 1 mm, densely pilosulous; lobes narrowly elliptic or oblanceolate to linear, 0.8–1.5 mm, glabrescent, acute. Corolla outside sparsely villosulous to glabrescent; tube 1.8–2.5 mm; lobes elliptic-spatulate, 1–1.5 mm, obtuse to rounded. Schizocarps ca. 1.5 × 1 mm, densely villosulous. Fl. Jul–Aug, fr. Aug.

- On rocks or in thickets on mountain slopes in dry and warm valleys; 1400–3000 m. Sichuan, Yunnan.

## 94. *UNCARIA* Schreber, *Gen. Pl.* 125. 1789, nom. cons.

钩藤属 *gou teng shu*

Chen Tao (陈涛); Charlotte M. Taylor

*Agylophora* Necker ex Rafinesque; *Ourouparia* Aublet.

Woody vines or lianas, climbing by recurved, usually paired spines generally 1–2 cm. Raphides absent. Leaves opposite, usually with domatia; stipules persistent or caducous, interpetiolar, generally ovate to ligulate in outline, entire to 2-lobed, usually reflexed. Inflorescences axillary and sometimes also terminal, capitate with heads globose and 1 to several in cymes or fascicles, pedunculate, bracteate; peduncles usually articulate in middle or upper portion, often with stipuliform bracts at articulation; bracts enclosing heads sometimes caducous, involucrel, stipuliform. Flowers sessile and bracteolate or pedicellate and bracteolate or ebracteolate, bisexual, monomorphic. Calyx limb 5-lobed. Corolla white to yellow, salverform or funnellform, inside glabrous or pubescent; lobes 5, imbricate in bud. Stamens 5, inserted in corolla tube near throat, exserted; filaments short; anthers dorsifixed. Ovary 2-celled, ovules numerous in each cell on axile placentas attached in upper third of septum; stigma globose or clavate, exserted. Fruiting heads globose, with fruiting pedicels when present often elongating notably. Fruit capsular, fusiform to obovoid, loculicidally dehiscent into 2 valves that usually remain attached at both ends, thinly to thickly papery or cartilaginous, with calyx limb persistent; seeds numerous, small to medium-sized, fusiform, flattened, winged with wing deeply bifid.

About 34 species: 29 in tropical Asia through Australia, three in Africa and Madagascar, two in tropical America; 12 species (five endemic) in China.

Ridsdale (*Blumea* 24: 43–46. 1978) presented an extensive consideration of the morphology, branching, and architecture of *Uncaria*. The characteristic hooked spines have been interpreted variously as modified plagiotropic shoots (Ridsdale, loc. cit.), peduncles that are modified into spines (e.g., Steyermark in Lasser, *Fl. Venezuela* 9: 32. 1974), and short shoots modified into thorns (Robbrecht, *Opera Bot. Belg.* 1: 1–271. 1988). By any name, these structures function to support the plants as they climb and sometimes bear a terminal inflorescence. Ridsdale (loc. cit.: 69) described the corolla lobe aestivation as valvate or thinly imbricate at their apices; other authors described them as imbricate. *Uncaria* was reviewed in detail for China by How (Sunyatsenia 6: 231–262. 1946), who emended the circumscriptions of several species, and then by Hsue and Wu (*J. S. China Agric. Coll.* 2(8): 21–32. 1981), who recognized ten species. The arrangement of the flowers and fruit, whether sessile or pedicellate, is taxonomically important; however, the pedicels usually elongate shortly before the flowers open and then continue to elongate as the fruit develop, often markedly, so the pedicel length at anthesis may be difficult to discern from inflorescences in bud.

*Uncaria* is considered medicinally useful, with uses ranging from general tonics to supposedly curing HIV-AIDS (e.g., K. C. Hsia & X. M. Liu, *Acta Phytotax. Sin.* 20: 319–320. 1982). Various parts of the plants are apparently used, with the materials generally wild-collected. *Uncaria gambir* (W. Hunter) Roxburgh, found from the Malay Peninsula through Borneo, is apparently both cultivated and wild-harvested as the source of gambir or gambier (Ridsdale, loc. cit.: 82; Mabberley, *Mabberley's Pl.-Book*, ed. 3, 885–886. 2008), a yellowish dry resin chewed together with the betel nut and sometimes used in tanning. How (loc. cit.) noted that the Chinese drug Kou-T'eng is derived from the “hardened sterile peduncle with attached portions of the stem” of a species that is probably *U. rhynchophylla*.

- 1a. Flowers subsessile to pedicellate, fruit pedicellate.
- 2a. Stipules suborbicular, 14–16 mm, entire ..... 12. *U. yunnanensis*
- 2b. Stipules ovate, 6–12 mm, shallowly to deeply 2-lobed.
- 3a. Leaves drying papery, 2–8 cm wide; flowers subsessile; fruit 1–3 mm wide ..... 5. *U. lanosa*
- 3b. Leaves drying thinly leathery, 6–12 cm wide; flowers with well-developed pedicels; fruit 4–5 mm wide ..... 6. *U. macrophylla*
- 1b. Flowers and fruit sessile to subsessile.
- 4a. Leaf blade abaxially strigillose, strigose, puberulent, and/or hirsute on lamina (but sometimes with different pubescence on veins); stems strigillose, tomentulose, strigose, hirtellous, hirsute, or pilosulous; stipules 2-lobed.
- 5a. Flowering heads 18–25 mm in diam. across calyces; stipule lobes ovate to lanceolate; calyx limb with tube 2–4 mm, lobes 2–3 mm ..... 1. *U. hirsuta*
- 5b. Flowering heads 9–12 mm in diam. across calyces; stipule lobes narrowly triangular, lanceolate, or ovate; calyx limb deeply lobed, lobes 0.75–2 mm.
- 6a. Corolla lobes ca. 1.25 mm; leaves 2.5–4 cm wide ..... 2. *U. homomalla*
- 6b. Corolla lobes ca. 2 mm; leaves 3–5.5 cm wide ..... 9. *U. scandens*
- 4b. Leaf blade abaxially glabrous to puberulent on lamina; stems glabrous, puberulent, sparsely hirsute, or sparsely hirtellous; stipules entire or 2-lobed.
- 7a. Stipules entire or shallowly emarginate, broadly triangular, ovate, or suborbicular ..... 11. *U. sinensis*
- 7b. Stipules 2-lobed, elliptic-oblong, ligulate, lanceolate, or ovate, with lobes narrowly triangular, linear, ovate, lanceolate, or triangular-ovate.
- 8a. Leaf blade drying thinly leathery; calyx lobes 0.1–0.3 mm.
- 9a. Leaf blade not glaucous abaxially, with tertiary venation mostly reticulate and not strongly scalariform on adaxial surface; peduncles simple; corolla lobes externally glabrous; fruit 6–8 mm ..... 3. *U. laevigata*
- 9b. Leaf blade often glaucous abaxially, with tertiary venation rather evidently scalariform at least on adaxial surface; peduncles simple or often branched; corolla lobes externally sericeous; fruit 10–14 mm ..... 10. *U. sessilifructus*
- 8b. Leaf blade drying thickly papery to thinly papery; calyx lobes 0.5–2 mm.
- 10a. Corollas 7–9 mm; leaf blade often drying reddish brown or dark red, often glaucous abaxially; calyx limb ca. 1 mm ..... 7. *U. rhynchophylla*
- 10b. Corollas 10.5–14.5 mm; leaf blade drying brown, grayish brown, or green, not glaucous abaxially; calyx limb 1.5–4 mm.
- 11a. Calyx limb ca. 1.5 mm ..... 8. *U. rhynchophylloides*
- 11b. Calyx limb 2–4 mm.
- 12a. Flowering heads 13–15 mm across calyces; leaves glabrous ..... 4. *U. lancifolia*
- 12b. Flowering heads 18–20 mm across calyces; leaves glabrous or usually puberulent at least on veins abaxially ..... 5. *U. lanosa*

**1. *Uncaria hirsuta*** Haviland, J. Linn. Soc., Bot. 33: 88. 1897.

毛钩藤 mao gou teng

*Nauclea formosana* Matsumura; *Ourouparia hirsuta* (Haviland) Yamamoto; *Uncaria formosana* (Matsumura) Hayata; *U. kawakamii* Hayata; *U. uraiensis* Hayata.

Lianas, height unknown. Young stems slender, terete or weakly 4-angled, sparsely to densely strigillose, strigose, or hirsute. Petiole 3–6 mm, strigose to strigillose; leaf blade drying thickly papery to thinly leathery, ovate, lanceolate-oblong, or elliptic, 8–12 × 3.5–7 cm, adaxially glabrous and smooth to sparsely puberulent-scabrous on lamina and puberulent on veins, abaxially sparsely to densely strigose with trichomes generally produced regularly along and at 90° to tertiary veins, apex acuminate; secondary veins 7–11 pairs, usually with hirtellous domatia; stipules generally deciduous, broadly ovate, 7–10 mm, 2-lobed for at least 2/3, strigillose, puberulent, or glabrescent, lobes ovate to lanceolate, ciliate, acute to acuminate. Inflorescences axillary or frequently paired and terminal on stems (apparently due to terminal bud not developing further), pilose

to pilosulous; peduncle 2.5–5 cm, simple; bracts 5–10 mm; flowering heads 18–25 mm in diam. across calyces, 30–40 mm in diam. across corollas; bracteoles linear or spatulate, ca. 2 mm. Flowers subsessile. Calyx with hypanthium portion obconic, ca. 2 mm, densely pilose to strigose; limb densely strigillose, with tube 2–4 mm; lobes linear-oblong, 2–3 mm. Corolla pale yellow or pale red, salverform, outside sparsely to densely strigillose; tube 7–10.5 mm; lobes oblong to elliptic, 2–2.5 mm, obtuse to rounded. Fruiting heads 30–35 mm in diam. Fruit subsessile, obovoid, 5–9 mm (not including persistent calyx limb), densely strigose; seeds ca. 1.5 mm. Fl. and fr. Jan–Dec.

• Thickets or forests at streamsides in valleys; below 100–500 m. Fujian, Guangdong, Guangxi, Guizhou, Taiwan.

H. H. Hsue and H. Wu (in FRPS 71(1): 257. 1999) listed “*Ourouparia setiloba* Sakai” as a synonym of this species, but that name is correctly “*Ourouparia setiloba* (Benth.) Sakai,” which is a combination based on *Uncaria setiloba*, here treated as a synonym of *U. lanosa* var. *appendiculata*. Hsue and Wu described the corolla tubes as 7–10 mm, but these are 8–10.5 mm on all the specimens studied and in descriptions of other authors.

**2. *Uncaria homomalla*** Miquel, Fl. Ned. Ind. 2: 343. 1857.

北越钩藤 bei yue gou teng

*Uncaria tonkinensis* Haviland.

Lianas, climbing to 25 m tall. Young stems quadrate, sparsely to densely, usually ferruginous tomentulose or -hirtellous. Petiole 3–6 mm, hirtellous to strigose; leaf blade drying papery, elliptic, lanceolate, elliptic-lanceolate, or ovate-lanceolate, 6–10 × 2.5–4 cm, adaxially rather sparsely but evenly puberulent to strigillose on lamina and densely tomentulose on costa, abaxially moderately to densely hirsute or strigose with trichomes produced mostly along veins, base rounded, apex acuminate or caudate; secondary veins 6–8 pairs, usually with well-developed pilosulous domatia; stipules generally deciduous, deeply 2-lobed, lobes narrowly triangular, 4–5 mm, acute. Inflorescences axillary and sometimes also terminal, densely hirtellous to strigose; peduncles simple, 2.5–3 cm, at articulation with narrowly triangular bracts 2–3 mm; flowering heads 7–10 mm in diam. across calyces, 25–30 mm in diam. across corollas; bracteoles apparently absent. Flowers sessile. Calyx with hypanthium portion obconic, ca. 1.2 mm; limb deeply lobed; lobes linear to narrowly triangular, 0.75–1 mm, densely pilosulous, acute. Corolla yellow [to pale green], outside densely strigose to strigillose; tube 5–8.5 mm; lobes ligulate to elliptic-oblong, ca. 1.25 mm, obtuse to rounded. Fruiting heads 12–20 mm in diam. Fruit sessile, obovoid, ca. 4 × 2 mm, strigose to pilosulous; seeds 2–3 mm. Fl. Apr, May.

Evergreen to seasonal forests; 200–600 m. Guangxi, Yunnan [Bangladesh, Cambodia, India, Indonesia, Laos, Malaysia, Myanmar, Thailand, Vietnam].

H. H. Hsue and H. Wu (in FRPS 71(1): 258. 1999) described the leaves as up to 5.5 cm wide, but this has not been seen on specimens studied nor reported by other authors. Ridsdale (Blumea 24: 95. 1978) reported this species from Guangdong and Hainan but without vouchers. The separation here of *Uncaria homomalla* and *U. scandens* follows previous Chinese authors, but the separation of these species (or possibly the application of these names to the Chinese plants) needs further study. Ridsdale (loc. cit.) separated *U. homomalla* from *U. scandens* based on the size of the flowering heads and leaves; however, Chinese specimens included previously in *U. scandens* (e.g., *Henry 11868*, MO!) have flowering heads and leaves similar in size to those of *U. homomalla*.

**3. *Uncaria laevigata*** Wallich ex G. Don, Gen. Hist. 3: 470. 1834.

平滑钩藤 ping hua gou teng

*Nauclea laevigata* (Wallich ex G. Don) Walpers.

Lianas, height unknown. Young stems slender, quadrangular, glabrous [to puberulent]. Petiole 7–11 mm, glabrous; leaf blade drying thinly leathery, elliptic, lanceolate, or elliptic-oblong, 8.5–12 × 3–6 cm, glabrous on both surfaces or puberulent on veins abaxially, base rounded to cuneate, apex acute or acuminate; secondary veins 4–7 pairs, usually with hirtellous domatia; stipules caducous, elliptic-oblong to ovate, 4–6 mm, 1-lobed for 1/2 or more, glabrous or sparsely puberulent, lobes narrowly triangular, acute. Inflorescences axillary and sometimes in terminal groupings, glabrous; peduncles 2.5–6 cm,

simple; bracts 2–4 mm; flowering heads 8–10 mm in diam. across calyces, 25–35 mm in diam. across corollas; bracteoles linear or subspatulate, 2–3 mm. Flowers sessile. Calyx with hypanthium portion obconic, 1–1.5 mm, densely sericeous or strigose; limb densely puberulent to strigillose, with tube 1–1.5 mm; lobes ligulate, 0.1–0.3 mm, obtuse. Corolla color unknown, salverform, glabrous outside; tube 7–10 mm; lobes oblong, ca. 2 mm, obtuse to rounded. Fruiting head 25–30 mm in diam. Fruit sessile, fusiform, 6–8 mm, strigose to strigillose; seeds not seen. Fl. and fr. May–Nov.

Forests; 600–1300 m. Guangxi, Taiwan, Yunnan [Bangladesh, India, Laos, Myanmar, Thailand, Vietnam].

**4. *Uncaria lancifolia*** Hutchinson in Sargent, Pl. Wilson. 3: 407. 1916.

倒挂金钩 dao gua jin gou

Large lianas, height unknown. Young stems quadrangular, glabrous. Petiole 3–5 mm, glabrous; leaf blade drying papery, oblong-lanceolate or ovate-lanceolate, 9–12 × 3–6 cm, glabrous on both surfaces, base rounded to truncate or subcordate, apex acute or acuminate; secondary veins 5–10 pairs, without domatia; stipules often persistent, ovate, 5–8 mm, 2-lobed for 1/3–1/2, glabrous, lobes lanceolate, acute. Inflorescences axillary and terminal, glabrous; peduncles 4–7 cm, simple; bracts caducous, ca. 5 mm; flowering heads ca. 15 mm in diam. across calyces, ca. 45 mm in diam. across corollas; bracteoles linear or linear-spatulate, 3–4.5 mm. Flowers sessile. Calyx with hypanthium portion obconic, ca. 3 mm, densely sericeous to pilose; limb densely puberulent to strigillose, with tube 1–2 mm; lobes spatulate, ca. 2 mm, obtuse to rounded. Corolla greenish white, salverform, glabrous; tube 9–12 mm; lobes oblong, 1.5–2.5 mm, obtuse to rounded. Fruiting head 25–35 mm in diam. Fruit sessile, obovoid, 9–12 mm, sericeous to strigose; seeds 2.5–3 mm. Fl. and fr. Jun–Dec.

Subtropical evergreen broad-leaved forests; 1500–1900 m. Yunnan [Vietnam].

How (Sunyatsenia 6: 252. 1946) first described the flowers of this species. H. H. Hsue and H. Wu (in FRPS 71(1): 253. 1999) described the leaves as having domatia; but the type specimen and several additional specimens studied lack these, and How did not mention them.

**5. *Uncaria lanosa*** Wallich var. ***appendiculata*** (Bentham) Ridsdale, Blumea 24: 88. 1978.

恒春钩藤 heng chun gou teng

*Uncaria appendiculata* Bentham, London J. Bot. 2: 222. 1843; *Ouroparia setiloba* (Bentham) Sakai; *U. lanosa* f. *setiloba* (Bentham) Ridsdale; *U. philippinensis* Elmer; *U. setiloba* Bentham.

Woody vines, height not noted. Young stems quadrangular, sparsely hirsute to glabrescent. Petiole 4–10 mm, sparsely hirsute to glabrescent; leaf blade drying papery, ovate, lanceolate, or lanceolate-oblong, 7–11 × 3.5–8 cm, adaxially shiny and glabrous except sparsely hirsute along veins, abaxially glabrescent except sparsely hirsute along veins, base rounded, truncate, or cordulate, apex acute to acuminate; secondary veins 6–9 pairs, usually with domatia in axils of secondary and often also ter-

tiary veins; stipules persistent or caducous, ovate, 6–10 × 8–10 mm, 2-lobed for 1/3–1/2, lobes narrowly triangular, acute to acuminate. Inflorescences axillary and frequently also terminal, strigose to hirsute or glabrescent; peduncle 2.5–4.5 cm; bracts ca. 10 mm; flowering heads solitary (or 2), 18–20 mm in diam. across calyces, 30–37 mm in diam. across corollas; bracteoles apparently absent. Flowers sessile or subsessile. Calyx densely strigillose; hypanthium portion fusiform, ca. 2 mm; limb deeply lobed; lobes linear, ca. 2 mm, obtuse. Corolla color unknown, salverform, externally sparsely sericeous to glabrescent; tube ca. 12 mm; lobes oblong, ca. 2.5 mm, obtuse. Fruiting heads 30–40 mm in diam.; pedicels 5–9 mm. Fruit pedicellate, fusiform, 9–27 × 1–3 mm, strigose; seeds 2.5–3 mm. Fl. Feb, perhaps Oct, fr. Feb.

Forests; ca. 300 m. S Taiwan [Indonesia (Sulawesi), Philippines].

Ridsdale (loc. cit.: 70) keyed *Uncaria lanosa* based on its stipules that are subtentate, but in our plants as well as the type of *U. philippinensis*, treated by him as a synonym of *U. lanosa* (NY, Web!), they are markedly 2-lobed.

*Uncaria lanosa* var. *lanosa* occurs in Australia, Borneo, Indonesia, Malaysia, Myanmar, New Guinea, Pacific islands (Caroline Islands, Palau, Solomon Islands), Philippines, and Thailand.

**6. *Uncaria macrophylla*** Wallich in Roxburgh, Fl. Ind. 2: 132. 1824.

大叶钩藤 da ye gou teng

Large lianas, height not noted. Young stems weakly to markedly quadrangular, pilosulous, tomentulose, or glabrescent. Petiole 3–25 mm, glabrous to densely tomentulose; leaf blade drying thinly leathery and yellowish brown adaxially, ovate or broadly elliptic, 10–16 × 6–12 cm, adaxially glabrous except strigillose along veins, abaxially sparsely to densely hirsutulous with pubescence denser along veins, base rounded, subcordate, or cordate, apex acute or shortly acuminate; secondary veins 6–9 pairs, usually with pubescent domatia; stipules caducous, ovate, 6–12 × 6–15 mm, 2-lobed for 1/2 or 2/3, lobes triangular to ovate. Inflorescences axillary, tomentulose to glabrescent; peduncle 3–7 cm; bracts triangular, 6–8 mm; flowering heads solitary, 15–20 mm in diam. across calyces, 40–50 mm in diam. across corollas; bracteoles absent; pedicels 2–5 mm. Flowers pedicellate. Calyx densely strigillose; hypanthium portion obconic, 2–2.5 mm; limb deeply lobed; lobes linear-oblong, 3–4 mm, obtuse to rounded. Corolla pale green to white, salverform, outside strigillose to tomentulose; tube 9–10 mm; lobes oblong to ligulate, ca. 2 mm, obtuse to rounded. Fruiting head 8–10 cm in diam.; pedicels 6–18 mm. Fruit pedicellate, fusiform, 14–20 × 4–5 mm, densely strigillose; seeds 6–8 mm. Fl. Jul, Sep, Dec, fr. Mar–Apr, Sep–Nov.

On canopy crowns in secondary forests; 300–900 m. Guangdong, Guangxi, Hainan, Yunnan [Bangladesh, Bhutan, India, Laos, Myanmar, N Thailand, Vietnam].

**7. *Uncaria rhynchophylla*** (Miquel) Miquel ex Haviland, J. Linn. Soc., Bot. 33: 890. 1897.

钩藤 gou teng

*Nauclea rhynchophylla* Miquel, Ann. Mus. Bot. Lugduno-

Batavi 3: 108. 1867; *Ourouparia rhynchophylla* (Miquel) Matsumura; *Uncaria rhynchophylla* var. *koutong* Yamazaki.

Lianas, height unknown. Young stems slender, weakly to markedly quadrangular, glabrous, sometimes glaucous. Petiole 5–15 mm, glabrous; leaf blade drying papery and often red-brown or dark red, elliptic, lanceolate, or elliptic-oblong, 5–12 × 3–7 cm, glabrous on both surfaces, often glaucous abaxially, base cuneate, obtuse, or rounded, apex acute to usually acuminate; secondary veins 4–8 pairs, sometimes with pilosulous domatia; stipules often deciduous, lanceolate to ovate, 4–15 mm, 2-lobed for up to 4/5, glabrous, lobes linear to triangular-lanceolate or ovate, acute to acuminate. Inflorescences axillary and terminal, solitary or usually in terminal groups of 7–11, glabrous; peduncles 1.5–5 cm, simple; bracts 1–4 mm; flowering heads 4–8 mm in diam. across calyces, 12–15 mm in diam. across corollas; bracteoles linear or linear-spatulate, ca. 2 mm. Flowers sessile or subsessile. Calyx with hypanthium portion obconic, ca. 1 mm, densely strigillose to strigose; limb densely strigillose, ca. 1 mm, lobed for 1/2 or more; lobes triangular to spatulate, acute to obtuse. Corolla color unknown, salverform, outside puberulent to glabrous; tube 5.5–6 mm; lobes ovate, 1.5–2 mm, rounded to obtuse. Fruiting head 10–20 mm in diam. Fruit sessile or subsessile, obovoid to fusiform, 5–7 mm, strigillose to strigose; seeds 2–3 mm. Fl. and fr. May–Dec.

Sparse forests or thickets at streamsides in valleys; near sea level to 1000 m. Fujian, Guangdong, Guangxi, Guizhou, Hubei, Hunan, Jiangxi, Yunnan, Zhejiang [Japan].

Ridsdale (Blumea 24: 93. 1978) included *Uncaria rhynchophylloides* as a synonym of *U. rhynchophylla*; however, these do appear to be distinct.

**8. *Uncaria rhynchophylloides*** F. C. How, Sunyatsenia 6: 257. 1946.

侯钩藤 hou gou teng

Lianas, to 13 m tall. Young stems quadrangular, puberulent to glabrescent. Petiole 5–7 mm, puberulent to glabrous; leaf blade drying thickly papery and dark brown to grayish brown, ovate, lanceolate, or elliptic-ovate, 5–9 × 2.5–4.5 cm, both surfaces puberulent to glabrescent, base cuneate to obtuse, rounded, or cordulate, apex acuminate; secondary veins 5–7 pairs, usually with pilosulous domatia; stipules generally persistent, ovate, deeply 2-lobed, glabrous to puberulent, lobes triangular to ovate, 3–4 mm, acute to acuminate. Inflorescences axillary and often in terminal groups of 3–5, puberulent to glabrescent; peduncles 3.5–6 cm, simple but sometimes with 2 articulations; bracts 3–4 mm; flowering heads 9–11 mm in diam. across calyces, 25–30 mm in diam. across corollas; bracteoles linear or linear-spatulate, 2.5–3.5 mm. Flowers sessile. Calyx with hypanthium portion obconic, ca. 1.5 mm, densely sericeous or strigose; limb deeply lobed, densely strigillose; lobes oblong to spatulate, ca. 1.5 mm, obtuse to rounded. Corolla color unknown, salverform, outside puberulent; tube ca. 12 mm; lobes obovate or oblong-obovate, 2–2.5 mm, rounded. Fruiting head 16–20 mm in diam. Fruit sessile, obovoid-ellipsoid, 8–10 × 3–3.5 mm, sericeous to strigillose; seeds not seen. Fl. and fr. May–Dec.

• Forests, forest margins; 500–800 m. Guangdong, Guangxi.

This species was illustrated by How (loc. cit.: 257, f. 31). Ridsdale (Blumea 24: 93. 1978) included *Uncaria rhynchophylloides* as a synonym of *U. rhynchophylla*; however, these do appear to be distinct.

**9. *Uncaria scandens*** (Smith) Hutchinson in Sargent, Pl. Wilson. 3: 406. 1916.

攀茎钩藤 pan jing gou teng

*Nauclea scandens* Smith in Rees, Cycl. 24: *Nauclea* no. 9. 1813; *Cephalanthus cavaleriei* H. Léveillé; *Uncaria wangii* F. C. How.

Large lianas, height not noted. Young stems slender, weakly to markedly quadrangular, densely hirtellous or pilosulous. Petiole 3–6 mm, hirtellous to pilosulous; leaf blade drying papery, ovate, ovate-oblong, lanceolate, elliptic, or elliptic-oblong, 10–15 × 3–5.5 cm, adaxially sparsely to moderately strigillose or scabrous-puberulent on lamina and densely puberulent to strigillose on veins, abaxially moderately to densely pilosulous, hirtellous, and/or strigillose usually with at least some pubescence spreading, base rounded to truncate, subcordate, or cordulate, apex acute or usually acuminate; secondary veins 7–10 pairs, usually with pilosulous domatia; stipules deciduous, ovate, 6–10 mm, deeply 2-lobed, strigillose, puberulent, or glabrescent, lobes lanceolate, ovate, or narrowly triangular, acute. Inflorescences axillary and often in terminal groups of 5–7 heads, densely pilosulous to tomentulose; peduncles 3–7 cm, simple; bracts 4–9 mm; flowering heads 9–12 mm in diam. across calyces, 25–30 mm in diam. across corollas; bracteoles linear or linear-spatulate, 1–3 mm, sparsely pubescent. Flowers sessile. Calyx with hypanthium portion obconic, 1–1.5 mm, densely strigose or pilose; limb 2–3 mm, lobed for up to 2/3, densely grayish white strigillose; lobes linear or linear-spatulate, 1.5–2 mm, obtuse. Corolla pale yellow sometimes flushed with pink, salverform, outside sparsely to densely hirtellous; tube 8–10 mm; lobes obovate to elliptic, ca. 2 mm, rounded. Fruiting head 20–25 mm in diam. Fruit sessile, obovoid to ob-lanceoloid, 6–9 mm, hirtellous; seeds orange-yellow, ca. 2 mm. Fl. Feb, Apr, fr. Jul, Nov.

• Sparse forests, broad-leaved forests; 100–1500 m. Guangxi, Hainan, Sichuan, Xizang, Yunnan.

This species was illustrated by How (Sunyatsenia 6: t. 42. 1946, as *Uncaria wangii*). See comments about the separation of this species under *U. homomalla*.

**10. *Uncaria sessilifructus*** Roxburgh, Fl. Ind. 2: 130. 1824.

白钩藤 bai gou teng

*Nauclea sessilifructus* (Roxburgh) D. Dietrich.

Large lianas, height unknown. Young stems slender, quadrangular, sparsely puberulent or hirtellous to glabrous. Petiole 5–10 mm, glabrous; leaf blade drying thinly leathery, ovate, elliptic, or elliptic-oblong, 8–12 × 4–6.5 cm, glabrous on both surfaces or abaxially puberulent on principal veins, often glaucous abaxially, base cuneate to rounded, apex acute or acuminate; secondary veins 4–7 pairs, usually with pilosulous domatia; stipules deciduous, ligulate to lanceolate, 7–10 mm, 2-lobed for 2/3 or more, glabrous to densely puberulent, lobes narrowly triangular, acute. Inflorescences axillary or terminal, heads solitary or in groups of 5–15, strigillose to glabrescent; peduncles

3–5.5 cm, simple or often branched to 1 order; flowering heads 5–10 mm in diam. across calyces, 25–35 mm in diam. across corollas; bracteoles linear or subspatulate, 2–3 mm. Flowers sessile. Calyx with hypanthium portion obconic, 1.5–2 mm, densely strigose to sericeous; limb densely strigillose to pilosulous, with tube 1–2 mm; lobes oblong to triangular, 0.25–1 mm, obtuse to acute. Corolla yellowish white, salverform; tube 6–10 mm, outside glabrous, pilosulous, or sericeous; lobes oblong, ca. 2 mm, outside sericeous or hirtellous, rounded to obtuse. Fruiting head 25–35 mm in diam. Fruit sessile, fusiform, 10–14 mm, sericeous; seeds not seen. Fl. and fr. Mar–Dec.

Dense forests or thickets in valleys; 300–1500 m. Guangxi, Yunnan [Bangladesh, Bhutan, India, Laos, Myanmar, Nepal, Vietnam].

This species was illustrated by Ridsdale (Blumea 24: 91, f. 11. 1978).

**11. *Uncaria sinensis*** (Oliver) Haviland, J. Linn. Soc., Bot. 33: 89. 1897.

华钩藤 hua gou teng

*Nauclea sinensis* Oliver, Hooker's Icon. Pl. 20: t. 1956. 1891; *Uncaria membranifolia* F. C. How.

Lianas, height unknown. Young stems slender, quadrangular, glabrous. Petiole 6–10 mm, glabrous; leaf blade drying thinly papery, elliptic to ovate, 9–14 × 5–8.5 cm, both surfaces sparsely puberulent to glabrous, base obtuse to rounded, apex acuminate; secondary veins 6–8 pairs, without domatia; stipules often persistent, broadly triangular, ovate, or orbicular, 3–10 mm, glabrous, rounded to truncate or sometimes shallowly emarginate. Inflorescences axillary, heads solitary or sometimes in terminal groups of 3–5, glabrous; peduncles 3–7 cm, rather slender; bracts 2–3 mm; flowering heads 10–15 mm in diam. across calyces, ca. 30 mm in diam. across corollas; bracteoles linear or subspatulate, 2–3 mm. Flowers subsessile. Calyx with hypanthium portion ca. 2 mm, densely strigose to strigillose; limb deeply lobed, densely strigillose; lobes linear-oblong, 1–1.5 mm, obtuse to rounded. Corolla color unknown, salverform; tube 7–8 mm, outside glabrous; lobes ligulate to triangular, ca. 2 mm, outside puberulent, acute to obtuse. Fruiting head 20–30 mm in diam. Fruit sessile, ellipsoid, 8–10 mm, strigillose to strigose; seeds not seen. Fl. and fr. Jun–Oct.

• Sparse forests or wet secondary forests at middle elevations; 900–1100 m. Gansu, Guangxi, Guizhou, Hubei, Hunan, Shaanxi, Sichuan, Yunnan.

This species was illustrated by How (Sunyatsenia 6: 254, f. 30. 1946, as *Uncaria membranifolia*).

**12. *Uncaria yunnanensis*** K. C. Hsia, Acta Phytotax. Sin. 20: 319. 1982.

云南钩藤 yun nan gou teng

Woody vines or lianas, to 15–25 m tall. Young branches weakly quadrangular, ferruginous villous. Petiole glabrous or ferruginous hirtellous; leaf blade drying leathery, ovate, elliptic, or elliptic-oblong, 9–18 × 5–8 cm, both surfaces glabrous, base obtuse, apex shortly acuminate; secondary veins ca. 4 pairs; stipules caducous, suborbicular, 14–16 mm, rounded. Inflorescences axillary and sometimes terminal, with heads solitary,

brown hirtellous; peduncle 30–35 mm; flowering heads 15–20 mm in diam. in bud. Flowers not seen. Fruiting head ca. 40 mm in diam.; pedicels 6–8 mm. Fruit pedicellate, fusiform, ca. 10 mm, brown hirtellous. Fl. Jul, fr. Jan.

- Forest margins, thickets. Yunnan (Xishuangbanna).

H. H. Hsue and H. Wu (in FRPS 71(1): 249. 1999) described the

petioles as ferruginous pubescent, but the protologue description of this species says “*petioli glabri nitiduli*,” though these “*petioli*” are described as structures belonging to “*pedunculus communis*” and may be pedicels rather than petioles.

The possibility cannot be completely excluded based on the information available that this name will be found synonymous with *Uncaria gambir*.

## 95. UROPHYLLUM Wallich in Roxburgh, Fl. Ind. 2: 184. 1824.

尖叶木属 *jian ye mu shu*

Chen Tao (陈涛); Charlotte M. Taylor

Trees or shrubs, sometimes dioecious, unarmed. Raphides present. Leaves opposite, often distichous on horizontal branches, apparently without domatia, with tertiary venation often regularly rectangular-areolate or clathrate and quaternary venation not visible; stipules persistent or caducous, interpetiolar, narrowly triangular to linear [or sometimes reduced], acute. Inflorescences axillary, capitate to cymose or often umbelliform, few to several flowered, pedunculate or sessile, bracteate or bracts reduced. Flowers pedicellate and ebracteate, bisexual and apparently monomorphic or sometimes unisexual. Calyx limb cupular, (4 or)5(–7)-toothed. Corolla white to yellow, rotate, shortly tubular, or funnelliform, inside villous in throat, leathery; lobes (4 or)5(–7), valvate in bud. Stamens (4 or)5(–7), inserted in corolla throat, included or exserted; filaments short; anthers apparently dorsifixed. Ovary (4 or)5(–7)-celled, ovules numerous in each cell on axile placentas attached at inner corner of cell; style often swollen at base; stigmas 3–8-lobed, exserted. Fruit white, orange, yellow, or red, baccate, fleshy, ellipsoid to subglobose, with calyx limb persistent; seeds numerous, small, subglobose; testa crustaceous, areolate; embryo clavate.

About 150 species: widespread in tropical Asia; three species (two endemic) in China.

Although this genus is sometimes said to range into Africa, more recently the African species formerly included in *Urophyllum* have all been moved to other genera (Lebrun & Stork, Énum. Pl. Fleurs Afr. Trop. 1–249. 1997). This genus does not seem well known, apart from a consideration of its delimitation in the Philippines by Bremekamp (J. Arnold Arbor. 21: 32–41. 1940). Puff et al. (Rubiaceae of Thailand, 134. 2005) found *Urophyllum* to be wholly dioecious in Thailand and noted that the staminate plants sometimes bear what they call “sterile pseudo-fruit consisting of [a] fleshy cuplike calyx and enlarged, empty ovaries [sic].” The reproductive biology of the Chinese species was not noted by H. S. Lo (in FRPS 71(1): 326–329. 1999).

- 1a. Leaves at apex rounded then abruptly caudate with tips narrowly triangular to linear, 15–20 mm; corolla ca. 2 mm ..... 2. *U. parviflorum*  
 1b. Leaves at apex acute or tapered to an acuminate apex, with tips narrowly triangular, 3–15 mm; corolla 3–4 mm.  
 2a. Stems flattened; stipules 10–19 mm; corolla lobed for ca. 1/2 ..... 1. *U. chinense*  
 2b. Stems subterete; stipules 7–10 mm; corolla lobed for ca. 1/3 ..... 3. *U. tsaiianum*

**1. *Urophyllum chinense*** Merrill & Chun, Sunyatsenia 2: 19. 1934.

尖叶木 *jian ye mu*

Shrubs or small trees, 1.5–4 m tall; branches compressed, longitudinally sulcate on each interpetiolar side, ascending strigose to sericeous, sometimes becoming glabrescent. Petiole 7–15 mm, strigillose to glabrescent; leaf blade drying papery, olive-green, oblong-elliptic, lanceolate, oblong-lanceolate, or rarely subovate, 8–20 × 2.5–6.5 cm, adaxially glabrous, abaxially sparsely to moderately strigillose with pubescence denser on veins, base obtuse to acute, apex acute to acuminate, tip 3–20 mm; secondary veins 7–9 pairs, tertiary venation subclathrate; stipules persisting on 1–3 apical nodes, narrowly lanceolate or narrowly oblong, 10–19 mm, densely strigose to sericeous, obtuse or acute. Inflorescences cymose, umbelliform, or corymbiform, several to many flowered, strigose to strigillose; peduncle 2–12 mm; bracts lanceolate, 2–3 mm, acute; pedicels 3–11 mm. Calyx strigillose or puberulent to glabrescent; hypanthium portion in staminate flowers obconic, ca. 0.5 mm, in pistillate flowers cupuliform, 1.5–2 mm; limb dentate, ca. 1 mm; lobes triangular. Corolla white, 3–4 mm, outside glabrous, vil-

lous in throat, 5-parted for ca. 1/2; lobes ovate to subtriangular. Berries red or orange-yellow, subglobose, ca. 8 mm in diam. Fl. Jun–Aug, fr. Aug–Oct.

Thickets on mountains; 400–900 m. Guangdong, Guangxi, Yunnan [N Vietnam].

**2. *Urophyllum parviflorum*** F. C. How ex H. S. Lo, Bull. Bot. Res., Harbin 18: 278. 1998.

小花尖叶木 *xiao hua jian ye mu*

Shrubs or small trees; branches laterally compressed, often longitudinally sulcate along interpetiolar sides, glabrous except sparsely hispidulous on nodes. Petiole 5–8 mm, hispidulous in lines; leaf blade drying papery, adaxially greenish gray, abaxially pale brown, elliptic-oblong, oblanceolate, or oblong-lanceolate, 13–16 × 3–5.5 cm, adaxially glabrous, abaxially hispidulous along principal veins and strigillose to glabrescent on higher order venation and blade, base acute to rounded, apex rounded then abruptly caudate, tips narrowly triangular to linear, 15–20 mm; secondary veins 7–10 pairs, tertiary veins generally parallel; stipules caducous or persisting on apical 1 or 2 nodes, narrowly lanceolate to narrowly ligulate, 7–13 mm,

densely sericeous, acute to obtuse. Inflorescences corymbose to umbelliform, several flowered, strigillose to hispid; peduncle 3–5 mm; bracts lanceolate-linear, ca. 2 mm; pedicels 3–9 mm. Calyx strigillose; hypanthium portion in pistillate flowers cupulate, ca. 1.5 mm; limb ca. 1 mm, shallowly 4- or 5-lobed; lobes triangular. Corolla ca. 2 mm, lobed for ca. 1/2; lobes 4 or 5, triangular. Berries ellipsoid to subglobose, ca. 4 × 5.5 mm. Fl. May, fr. Aug.

- About 700 m. Yunnan (Jinping).

**3. *Urophyllum tsaianum*** F. C. How ex H. S. Lo, Bull. Bot. Res., Harbin 18: 279. 1998.

滇南尖叶木 *dian nan jian ye mu*

Shrubs or small trees, 2–6 m tall; branches subterete,

hispidulous. Petiole 5–8 mm, hispidulous; leaf blade drying papery, pale brown or greenish gray, narrowly lanceolate, narrowly elliptic-oblong, elliptic-oblong, or lanceolate, slightly inequilateral, 6–13.5 × 2–4 cm, adaxially glabrous, abaxially strigillose, base obtuse or acute, apex acuminate; secondary veins 6–9 pairs; stipules linear-lanceolate, 7–10 mm, densely adpressed sericeous or -villous, acuminate. Inflorescences corymbiform to umbelliform, few to several flowered, hispidulous; peduncle 5–10 mm; bracts subulate, ca. 2 mm; pedicels 3–6 mm, unequal. Calyx hispidulous to glabrous; hypanthium portion cupulate, ca. 2 mm; limb deeply lobed; lobes broadly triangular, ca. 0.6 mm. Corolla yellow or white, tubular, ca. 3 mm, glabrous outside, lobed for ca. 1/3; lobes triangular. Berries red, globose, ca. 5 mm in diam. Fl. Jul, fr. Jan–Feb.

- Dense forests on mountains; 1000–1500 m. S Yunnan.

## 96. *WENDLANDIA* Bartling ex Candolle, Prodr. 4: 411. 1830, nom. cons., not Willdenow (1799).

水锦树属 *shui jin shu shu*

Chen Tao (陈涛); Charlotte M. Taylor

Shrubs or trees, unarmed; branches sometimes flattened. Raphides absent. Leaves opposite or occasionally in whorls of 3, without or rarely with domatia, with margins rarely denticulate (apparently where scabrous projections form triangular thickenings), infrequently with venation not visible abaxially; stipules persistent or caducous as a whole or by fragmentation, interpetiolar, triangular to pandurate or leaflike (i.e., generally ovate and narrowed to a stipitate base), entire or rarely bilobed, erect and flat to longitudinally folded and/or spreading to reflexed. Inflorescences terminal, cymose, thyrsoid, or paniculiform, many flowered, sessile to pedunculate, bracteate. Flowers sessile or pedicellate, bisexual, monomorphic, often fragrant. Calyx limb 5-lobed. Corolla white, purple, or red, tubular, salverform, or funnellform, glabrous or pubescent inside, with top portion of tube often reflexed at anthesis; lobes (4 or)5, imbricate in bud, strongly reflexed to revolute at anthesis. Stamens (4 or)5, inserted in corolla tube near throat, partially to fully exerted; filaments short to developed; anthers dorsifixed, sometimes with connective prolonged in short apical and/or basal appendages. Ovary 2(or 3)-celled, ovules numerous in each cell on peltate axile placentas; stigma bifid or rarely clavate and shortly emarginate at apex (*Wendlandia pendula*), exerted. Fruit capsular, subglobose, loculicidally dehiscent across apical portion into 2 valves with valves later sometimes splitting septically, papery to woody, with calyx limb persistent; seeds numerous, small, compressed, sometimes narrowly winged; testa membranous, reticulate-striate; endosperm fleshy.

At least 90 species: mainly in tropical and subtropical Asia and a few in the Pacific region; 31 species (21 endemic) in China.

The flowers seem to open generally all at once on an individual plant and perhaps in the population. They are reported in several species to be strongly fragrant. W. C. Chen (in FRPS 71(1): 191. 1999) described the fruit as rarely septical, but this has not been reported by other authors and has not been seen on the specimens studied.

*Wendlandia* has been studied by several authors, notably in a comprehensive monograph by Cowan (Notes Roy. Bot. Gard. Edinburgh 16: 233–313, t. 232–235. 1932, with supplemental notes shortly afterward; Notes Roy. Bot. Gard. Edinburgh 18: 183–188. 1934) and then in treatments of the Chinese species by F. C. How (Sunyatsenia 7(1–2): 32–62. 1948) and later W. C. Chen (Acta Phytotax. Sin. 21: 277–284, 386–403. 1983).

Many *Wendlandia* species seem to be morphologically variable with much of the variation difficult to partition into distinct clusters, as discussed by Cowan (loc. cit. 1932). Cowan also evaluated characters used by various authors to distinguish species and concluded that many were variable and/or incorrectly interpreted, although he used several of these to distinguish infraspecific taxa. With more species known now, there also seems to be variation within species in some of the characters that Cowan considered reliable to distinguish species. W. C. Chen (loc. cit. 1983) used Cowan's characters to delimit some of his new species, but circumscribed other species to include a relatively wide range of variation in some of the same features (e.g., *W. pingpiensis*).

Cowan recognized four series and four subseries, distinguished by stigmas, anther, and stipule morphology as well as habit. These taxa were accepted by W. C. Chen in FRPS (loc. cit. 1999: 195, 196, 200, 202, 208, 218, 221); however, the classification following Cowan's treatment of several Chinese *Wendlandia* species described by recent authors is problematic because flowers are needed but are unknown for these. The key published by W. C. Chen (loc. cit. 1999: 192–195) closely follows that of Cowan except some leads were numbered incorrectly while others appear to be missing, and the updated information on morphological variation and geographic distribution was not added to the key so could be problematic to use. The key to *Wendlandia* species here follows that of W. C. Chen, to outline for reference the species distinctions in that treatment; however, it has been augmented with the new morphological and distributional information.

In addition to the species treated here, F. C. How (loc. cit.: 43) reported *Wendlandia ternifolia* Cowan provisionally from China based on *Tsang 21937*, *Liang 67941*, and *Zoo 69290*. However, W. C. Chen in FRPS (loc. cit. 1999: 192) commented that study of *Tsang 21937* showed the calyx to have stiff pubescence, which is inconsistent with the protologue description of *W. ternifolia*, while the other two specimens cited have no flowers in

adequate condition for identification. Therefore, *W. ternifolia* was excluded from the Chinese flora; no new or alternative identification was given by Chen for these specimens.

- 1a. Most or all flowers with well-developed pedicels 2–6 mm; stipules triangular to broadly triangular, acute, cuspidate, or narrowly spatulate.
- 2a. Shrubs or trees; petioles 0.5–1.5 cm; corolla lobes 1–2.5 mm; anthers 0.8–2 mm, subsessile or with filaments less than 1 mm.
- 3a. Corolla with lobes ca. 1 mm, less than half as long as tube; anthers ca. 1 mm ..... 12. *W. laxa*
- 3b. Corolla with lobes 1.5–2.5 mm, half as long as tube to  $\pm$  equal to tube; anthers 1.2–2 mm.
- 4a. Leaves abaxially with secondary and higher order venation well marked; corolla white to yellow, with tube 1.5–4 mm ..... 8. *W. formosana*
- 4b. Leaves abaxially with secondary and higher order venation hardly visible; corolla purplish red, with tube 2.3–3 mm ..... 16. *W. longipedicellata*
- 2b. Low shrubs or sometimes trees up to 12 m tall; petioles 0.1–0.6 cm; corolla lobes 3.5–8 mm; anthers 2–3.5 mm, exserted on filaments 4–6 mm (*W. ser. Montigenae* Cowan).
- 5a. Shrubs or trees 1–12 m tall; leaves elliptic-oblong, oblong-lanceolate, oblanceolate, or elliptic, 3–14.5 cm, glabrous on both surfaces; stipules spatulate to lanceolate or leaflike (i.e., ovate and stipitate); Hainan ..... 18. *W. merrilliana*
- 5b. Leaves elliptic-lanceolate, lanceolate, narrowly lanceolate, ovate, or suborbicular, 0.8–3 cm, pubescent on one or both surfaces; stipules triangular, lanceolate-triangular, or ovate; mainland.
- 6a. Leaves acute, shortly acuminate, or obtuse at apex, with secondary veins ca. 3 pairs, visible abaxially; calyx lobes linear-oblong, spatulate, or oblanceolate ..... 15. *W. longidens*
- 6b. Leaves obtuse at apex, veins not visible abaxially; calyx lobes triangular or lanceolate ..... 28. *W. subalpina*
- 1b. Flowers sessile to shortly pedicellate, with pedicels up to 2 mm; stipules variously shaped, generally triangular, spatulate, ovate, suborbicular, leaflike, or pandurate.
- 7a. Stipules triangular, ovate, broadly triangular, or leaflike, at apex acute, cuspidate, ligulate, or aristate, erect or slightly spreading with age.
- 8a. Leaves subsessile or shortly petiolate, petioles up to 3 mm.
- 9a. Leaves opposite or ternate, ovate to ovate-lanceolate, 1.8–4 cm wide, drying papery, margins not thickened nor edged with a vein; stigma clavate ..... 22. *W. pendula*
- 9b. Leaves opposite, narrowly elliptic to narrowly lanceolate, 0.4–1.2 cm wide, drying thinly leathery, marginally edged with a thickened vein; stigma deeply bilobed ..... 25. *W. salicifolia*
- 8b. Leaves petiolate, petioles 3–25 mm.
- 10a. Stipule apex prolonged, ligulate, 5–7 mm ..... 9. *W. grandis*
- 10b. Stipule apex acute, cuspidate, or shortly acicular, 0.5–2 mm.
- 11a. Calyx lobes narrowly triangular to linear, 1–1.2 mm, equal or unequal on an individual flower with at least one of lobes longer than 1 mm.
- 12a. Petioles 0.8–1.2 cm; stipules ca. 5 mm; corolla lobes ca. 1 mm ..... 6. *W. cavaleriei*
- 12b. Petioles 0.8–1.5 cm; stipules 2–3 mm; corolla lobes 1.5–2.2 mm ..... 13. *W. ligustrina*
- 11b. Calyx lobes lanceolate, triangular, or spatulate, 0.3–1.2 mm, equal or subequal.
- 13a. Leaves strigillose to puberulent on both surfaces; corolla tube 8.5–11 mm ..... 1. *W. aberrans*
- 13b. Leaves strigillose, puberulent, tomentulose, villous, or glabrescent on both surfaces; corolla tube 1.5–4 mm.
- 14a. Calyx lobes 0.3–0.5 mm ..... 8. *W. formosana*
- 14b. Calyx lobes 0.8–1 mm.
- 15a. Inflorescences smaller, 5–6  $\times$  3–6 cm; calyx glabrous or sparsely villosulous; leaves sparsely pubescent to glabrous abaxially ..... 4. *W. brevipaniculata*
- 15b. Inflorescences larger, 9–17  $\times$  6–22 cm; calyx glabrous to densely pilosulous, hirtellous, or villosulous; leaves glabrous to strigillose, tomentose, or villous abaxially.
- 16a. Inflorescences 9–17  $\times$  9–22 cm; corolla outside with tubes and lobes variously glabrous, strigillose, and/or villosulous (including glabrous on tube and densely villosulous on lobes in subsp. *affinis*) ..... 29. *W. tinctoria*
- 16b. Inflorescences 9–12  $\times$  6–11 cm; corolla outside glabrous on tube and densely villosulous or hirtellous on lobes ..... 31. *W. villosa*
- 7b. Stipules triangular, ovate, suborbicular, leaflike, or pandurate, with apex obtuse, rounded, shortly acuminate, 2-lobed, or ligulate and usually spreading to reflexed.
- 17a. Anthers linear-lanceolate, 1.3–2 mm, exserted from corolla on developed filaments; corolla 7–9.4 mm; capsule 2.5–3 mm in diam. (*W. ser. Euexsertae* Cowan p.p., *W. subser. Orbiculares* Cowan) ..... 27. *W. speciosa*

- 17b. Anthers lanceolate or elliptic, 0.5–1.7 mm, partially included, sessile or with filaments less than 1 mm; corolla 2–13.5 mm; capsule 1–2.5 mm in diam. (fruit unknown in *W. augustinii*, *W. erythroxyton*, *W. myriantha*, *W. parviflora*, *W. pubigera*) (*W.* ser. *Wendlandia* p.p., *W.* subser. *Paniculatae* Cowan).
- 18a. Leaves abaxially densely strigose or sericeous along midrib; inflorescences smaller, 4–10.5 × 3–10 cm; corolla 11.5–13.5 mm, red or purple; capsule 2–2.5 mm in diam. .... 3. *W. bouvardioides*
- 18b. Leaves abaxially glabrous, glabrescent, or sparsely to densely strigillose, puberulent, pilosulous, tomentose, hispidulous, or hirtellous; inflorescences often larger, 4–30 × 4–25 cm; corolla 2–6 mm, white, pale green, pale yellow, or yellowish green; capsule 1–2 mm in diam. (unknown in *W. augustinii*, *W. erythroxyton*, *W. myriantha*, *W. parviflora*, *W. pubigera*).
- 19a. Corolla tube 1–1.5 mm, with lobes equal to, longer than, or sometimes slightly shorter than tube; leaves 5–17 × 2–8.5 cm.
- 20a. Leaves glabrescent or sparsely strigillose to pilosulous abaxially; Guangdong, Guangxi ..... 5. *W. brevitiba*
- 20b. Leaves densely ferruginous pubescent abaxially; Yunnan ..... 21. *W. parviflora*
- 19b. Corolla tube 2–5 mm, with lobes clearly shorter than tube; leaves 3–26 × 1.5–14 cm.
- 21a. Leaves drying leathery, abaxially with secondary veins plane and tertiary venation hardly or not visible.
- 22a. Calyx densely hirtellous ..... 14. *W. litseifolia*
- 22b. Calyx glabrous to sparsely strigillose ..... 20. *W. oligantha*
- 21b. Leaves drying papery to leathery, abaxially with secondary veins raised and tertiary venation easily visible and usually also raised (i.e., most common condition).
- 23a. Calyx glabrous to sparsely puberulent, with lobes 1.2–2 mm, entire to ciliate.
- 24a. Calyx lobes 1.2–2 mm; corolla tube 2–3.5 mm; Guangdong, Hainan ..... 10. *W. guangdongensis*
- 24b. Calyx lobes 1.2–1.5 mm; corolla tube 2.5–4 mm; Guangxi, Taiwan.
- 25a. Leaves entire or scabrous to denticulate marginally; stipules entire; Taiwan ..... 7. *W. erythroxyton*
- 25b. Leaves entire, smooth or ciliate marginally; stipules entire or 2-lobed; Guangxi ..... 19. *W. myriantha*
- 23b. Calyx with hypanthium portion and limb glabrous, glabrescent, or pilosulous, puberulent, tomentose, hirtellous, pilose, strigose, or strigillose, with lobes 0.3–1 mm.
- 26a. Leaves abaxially moderately to densely hirtellous, strigillose, pilosulous, pilose, or strigose with pubescence on lamina spreading and/or partly obscuring its surface.
- 27a. Leaves scaberulous on lamina adaxially; stipules usually equal to or only slightly wider than stem; corolla inside with short trichomes confined to lower to upper part of tube; Yunnan ..... 26. *W. scabra*
- 27b. Leaves sparsely hirtellous, hispidulous or scaberulous adaxially; stipules usually twice or more as wide as stem; corolla hirsute inside upper part of tube and throat ..... 30. *W. uvariifolia*
- 26b. Leaves abaxially glabrous to sparsely strigillose or hispidulous on lamina and strigillose to moderately hispidulous or hirtellous on principal veins.
- 28a. Leaves abaxially glabrous on lamina and sparsely strigillose and/or hirtellous on principal veins; Taiwan ..... 17. *W. luzoniensis*
- 28b. Leaves abaxially glabrous to hispidulous or strigillose; mainland.
- 29a. Stipules with apex ligulate, obtuse, often longitudinally folded ..... 9. *W. grandis*
- 29b. Stipules with apex oblanceolate to suborbicular, folded to usually flat.
- 30a. Corolla tube 4–5 mm; Yunnan.
- 31a. Stipules with apical portion 3–4 mm wide; leaves with secondary veins 7–9 pairs ..... 2. *W. augustinii*
- 31b. Stipules with apical part broad, ca. 10 mm wide; leaves with secondary veins 7–13 pairs ..... 23. *W. pingpiensis*
- 30b. Corolla tube 2–3 mm.
- 32a. Leaves smaller, 7–10.5 × 2–4 cm, abaxially glabrous on lamina and sparsely pubescent only on veins; secondary veins 7 or 8 pairs; Yunnan ..... 11. *W. jingdongensis*
- 32b. Leaves larger, 14.5–18 × 6–7 cm, abaxially glabrous to sparsely pubescent on lamina with pubescence denser along veins; secondary veins 10 or 11 pairs; Guangxi .... 24. *W. pubigera*

**1. *Wendlandia aberrans*** F. C. How, Sunyatsenia 7(1–2): 44. 1948.

广西水锦树 *guang xi shui jin shu*

Shrubs, 1–3 m tall; branches terete, yellowish brown, densely adpressed ferruginous hirsute. Leaves opposite; petiole 3–10 mm, appressed yellowish brown pubescent; blade drying papery and reddish yellow, oblong-elliptic or ovate-elliptic, 5–

16 × 2–5.8 cm, adaxially adpressed puberulent with pubescence denser along midrib, abaxially sparsely puberulent with pubescence denser along principal veins, base cuneate or acute, apex shortly caudate-acuminate or acute; secondary veins 6–12 pairs; stipules late deciduous to persistent, triangular, 3–5 mm, yellowish brown pubescent becoming glabrescent, cuspidate. Inflorescences congested-paniculate, narrowly pyramidal in outline, 5–10 × 3–8 cm, appressed ferruginous pubescent, tripartite

and sessile or pedunculate; bracts leaflike or filiform. Flowers subsessile to shortly pedicellate. Calyx grayish white pilosulous or hirtellous; hypanthium portion subglobose, 0.8–1.2 mm; limb lobed nearly to base; lobes lanceolate to triangular, 0.7–1.2 mm. Corolla reddish white, slenderly funnelliform, glabrous outside; tube 8.5–11 mm, sparsely white villous at middle inside; lobes oblong-ovate, 1.5–2 mm. Anthers linear-oblong, 1–1.7 mm, subsessile, partially exerted. Stigma 2-lobed, ca. 0.8 mm. Capsules not seen. Fl. Apr–Dec.

- Forests on hill slopes; 900–1200 m. Guangxi (Napo).

W. C. Chen's key (in FRPS 71(1): 192. 1999) described the leaves of this species as hispidulous on both surfaces, but this conflicts with the protologue and Chen's species description.

**2. *Wendlandia augustinii*** Cowan, Notes Roy. Bot. Gard. Edinburgh 16: 298. 1932.

思茅水锦树 si mao shui jin shu

Shrubs, 2–3 m tall; branches terete, densely tomentulose to hirtellous becoming glabrescent. Leaves opposite; petiole 5–15 mm, densely tomentulose; blade drying papery, elliptic or elliptic-ovate, 9–15.5 × 2–6 cm, adaxially sparsely hispidulous to glabrous on lamina and sparsely to densely puberulent on principal veins, abaxially sparsely strigillose to hispidulous, base cuneate to acute, apex acute to acuminate; secondary veins 7–9 pairs; stipules generally persistent, pandurate, 5–7 × 3–4 mm, densely hirtellous, pilosulous, or strigillose, apically spreading, obtuse to rounded. Inflorescences paniculate, pyramidal in outline, 11–12 × 11–14 cm, branched to 2 or 3 orders, densely pilosulous to strigillose, pedunculate; peduncle 0.8–1.5 cm; bracts linear to narrowly lanceolate, 1–1.5 mm. Flowers sessile or subsessile. Calyx densely pilosulous to puberulent; hypanthium portion ellipsoid to turbinate, 0.8–1.2 mm; limb deeply lobed; lobes triangular, ca. 0.3 mm. Corolla white, funnelliform, outside glabrous; tube 4–5 mm, inside glabrous or puberulent in throat; lobes ovate, 0.6–1 mm. Anthers elliptic, subsessile, ca. 0.8 mm, partially exerted. Stigma bilobed, ca. 0.4 mm. Capsules not seen.

- Forests on mountains; ca. 1300 m. Yunnan (Simao).

**3. *Wendlandia bouvardioides*** Hutchinson in Sargent, Pl. Wilson. 3: 393. 1916.

薄叶水锦树 bao ye shui jin shu

Shrubs or small trees, 1–5 m tall; branches terete, densely strigose to hirsute. Leaves opposite; petiole 0.4–1.2 cm, strigose to strigillose; blade drying thinly papery, elliptic, narrowly elliptic, or lanceolate, 5–20 × 1.2–5.5 cm, adaxially strigillose on principal veins and glabrescent on lamina, abaxially glabrescent on lamina, strigose to sericeous on principal veins, and strigillose on higher order veins, base acute to attenuate, apex long acuminate; secondary veins 5–8 pairs; stipules deciduous, suborbicular, ovate, or leaflike, 3–5 × 3.5–5 mm, strigose to glabrescent, base shortly stipitate, apex spreading to reflexed, obtuse to shortly acuminate. Inflorescences congested-cymose or thyrsoid, cylindrical in outline, branched to 1 or 2 orders, 4–10.5 × 3–10 cm, densely strigose, hirsute, or strigillose, subsessile to pedunculate; peduncle to 1 cm; bracts subulate, linear,

narrowly triangular, or lanceolate, 1–5 mm; pedicels to 1 mm. Flowers subsessile to pedicellate. Calyx densely strigillose; hypanthium portion turbinate, ca. 1 mm; limb deeply lobed; lobes lanceolate to narrowly triangular, 0.3–1.5 mm, unequal on an individual flower (this entire size range found on one flower). Corolla red or purple, salverform or tubular, outside glabrous; tube 10–11 mm; lobes oblong to lanceolate, 1.5–2.5 mm, obtuse to rounded. Anthers lanceolate, 1–1.7 mm, partially exerted, subsessile. Stigma 2-lobed, 0.3–0.5 mm. Capsules globose, 2–2.5 mm in diam., strigillose. Fl. Feb–Dec, fr. May–Dec.

- Thickets or forests in valleys, on mountain slopes, or at stream-sides; 1200–1800 m. Yunnan.

This species seems to have been grouped together with *Wendlandia* species with relatively long, fully exerted anthers by W. C. Chen (in FRPS 71(1): 192–193. 1999), but it actually has relatively short fat anthers that are not exerted, as noted in the protologue.

**4. *Wendlandia brevipaniculata*** W. C. Chen, Acta Phytotax. Sin. 21: 386. 1983.

吹树 chui shu

Trees; branches subterete, yellowish brown velutinous or mealy pubescent. Leaves opposite; petiole 0.8–1.2 cm, puberulent; blade drying leathery, elliptic or ovate-elliptic, 4.5–10.5 × 2.5–4.5 cm, sparsely pubescent to glabrescent on both surfaces with pubescence denser along principal veins, base cuneate to obtuse, apex abruptly shortly acuminate or acute; secondary veins 8–10 pairs; stipules generally persistent, triangular to ovate, ca. 4 mm, puberulent to strigillose, apex cuspidate, erect. Inflorescence paniculate, subglobose, 5–6 × 3–6 cm, densely tomentose or strigillose to glabrescent, sessile and tripartite or pedunculate; peduncle 0.8–1.8 cm; bracts lanceolate to linear, 1–5 mm. Flowers subsessile. Calyx glabrous or sparsely villosulous; hypanthium subglobose, ca. 0.8 mm; limb lobed nearly to base; lobes lanceolate, ca. 0.8 mm. Corolla tubular-salverform, outside glabrous or villosulous on lobes; tube 2–3 mm, white hirsute inside; lobes elliptic, ca. 1 mm. Filaments ca. 0.8 mm; anthers elliptic, ca. 0.8 mm, partially exerted. Stigma 2-lobed, ca. 0.2 mm. Capsules globose, ca. 2 mm in diam., puberulent, villosulous, or subglabrous. Fl. and fr. Sep.

- Forests; 200–300 m. Yunnan (Jingdong).

**5. *Wendlandia brevituba*** Chun & F. C. How ex W. C. Chen, Acta Phytotax. Sin. 21: 397. 1983.

短筒水锦树 duan tong shui jin shu

Shrubs, 0.5–3 m tall; branches flattened to terete, densely hirtellous, pilosulous, or strigillose. Leaves opposite; petiole 0.3–1.5 cm, densely hirtellous or pilosulous; blade drying papery, elliptic-oblong, elliptic-ovate, or elliptic, 5–15 × 2–6.3 cm, adaxially glabrous or sparsely strigillose on lamina and densely strigillose on principal veins, abaxially sparsely strigillose to glabrous on lamina and densely strigillose to pilosulous on principal veins, base cuneate, apex acuminate to shortly acuminate; secondary veins 4–8 pairs; stipules deciduous, suborbicular, elliptic, or pandurate, 2–6 × 1.5–4 mm, moderately to densely strigillose, spreading at apex to fully reflexed, apex obtuse to rounded. Inflorescences rather laxly paniculate, pyra-

midal in outline, branched to 1 or 2 orders, 4–7 × 4–11 cm, densely pilosulous to hirtellous, sessile and tripartite or pedunculate; peduncle 0.3–3.5 cm; bracts linear to triangular, 0.3–1 mm. Flowers subsessile. Calyx densely strigillose to pilosulous; hypanthium portion subglobose, ca. 0.8 mm; limb deeply lobed; lobes lanceolate to triangular, 0.5–1 mm. Corolla white, tubular or salverform, sparsely pilosulous or glabrous outside; tube 1–1.5 mm, sparsely pubescent or glabrescent inside; lobes oblong-ovate or subovate, 1–1.5 mm, rounded to obtuse. Anthers elliptic, ca. 0.8 mm, subsessile, partially exerted. Stigma bifid, ca. 1 mm. Capsules subglobose, 1–1.5 mm in diam., pilosulous. Fl. Apr–May, fr. Jun–Dec.

- Forests in valleys; 100–900 m. Guangdong, Guangxi.

**6. *Wendlandia cavalieri*** H. Léveillé, *Repert. Spec. Nov. Regni Veg.* 10: 434. 1912.

贵州水锦树 *gui zhou shui jin shu*

*Wendlandia feddei* H. Léveillé.

Shrubs or small trees, 1.5–3 m tall; branches brown, subterete, strigillose to glabrescent. Leaves opposite; petiole 0.8–1.2 cm, strigillose; blade drying subleathery, ovate, elliptic, or oblanceolate-elliptic, 4.5–13.5 × 2–6 cm, adaxially glabrous to sparsely strigillose on lamina and sparsely pubescent along midrib, abaxially sparsely hirsute with pubescence denser along veins, base obtuse to acute, apex acute or acuminate; secondary veins 7–10 pairs; stipules generally persistent, broadly triangular, ca. 5 mm, strigillose, apex erect, cuspidate. Inflorescence paniculate, pyramidal to ovate in outline, 7–21 × 6–15 cm, densely many flowered, branched to 2 or 3 orders, densely yellowish brown pilosulous, sessile and tripartite or pedunculate; peduncle 1–6 cm; bracts triangular, 1–3 mm. Flowers sessile. Calyx densely hirtellous to pilosulous; hypanthium portion subglobose, ca. 1 mm; limb deeply lobed; lobes narrowly triangular, 1–1.2 mm. Corolla white or purple, tubular-funnelform, glabrous to pilosulous; tube ca. 3.5 mm, inside white villosulous; lobes ovate to elliptic, ca. 1 mm. Anthers elliptic, ca. 0.8 mm, subsessile, partially exerted. Stigma 2-lobed, ca. 0.7 mm. Capsules globose, ca. 1.5 mm in diam., pilosulous. Fl. Mar–Apr, fr. Apr.

- Forests or thickets on hill slopes; 200–700 m. Guangxi (Tianyang), Guizhou.

W. C. Chen (in *FRPS* 71(1): 203. 1999) described the corollas as glabrous outside, but Cowan (*Notes Roy. Bot. Gard. Edinburgh* 16: 263–264. 1932) specifically noted that the corollas of *Wendlandia cavalieri* vary from glabrous to pubescent in China, as described here.

**7. *Wendlandia erythroxylo***n Cowan, *Notes Roy. Bot. Gard. Edinburgh* 16: 299. 1932.

红木水锦树 *hong mu shui jin shu*

Trees, ca. 7 m tall; wood firm, red; branches quadrate, brownish gray, moderately to densely mixed pubescent, hirsute and pilosulous, sometimes becoming glabrescent. Leaves opposite; petiole 0.5–1 cm, moderately to densely strigillose to hirtellous; blade drying leathery or papery, elliptic-ovate, obovate, or ovate, 5–12 × 3–5.5 cm, adaxially sparsely strigillose or hirtellous to glabrescent, abaxially sparsely to moderately hirtel-

lous with pubescence denser along principal veins, base obtuse to acute, margins scaberulous to denticulate, apex acute to acuminate; secondary veins 6 or 7 pairs; stipules generally persistent, suborbicular to pandurate, 5–8 × 4–5.5 mm, sparsely to densely strigillose or strigose basally and glabrescent above, apex usually spreading to reflexed, obtuse to rounded. Inflorescence rather laxly paniculate, 5–13 × 3–12.5 cm, sparsely to densely hirtellous to hirsute, tripartite and sessile or pedunculate; peduncle 1–6 cm; bracts ligulate to lanceolate or narrowly elliptic, 1.2–5 mm, often glabrescent. Flowers sessile or subsessile. Calyx glabrous or sparsely pilose; hypanthium portion subglobose to ellipsoid, ca. 0.8 mm; limb lobed nearly to base; lobes ovate-oblong to ligulate, ca. 1.2 mm, ciliate. Corolla tubular to salverform, glabrous outside; tube 2.5–3 mm, in throat white hirsute; lobes ovate, 1–1.2 mm. Anthers elliptic, ca. 0.8 mm, subsessile, partially exerted. Stigma ca. 0.5 mm, 2-lobed. Capsules unknown. Fl. Apr–Oct.

- Forests on hills of low elevations. Taiwan.

The leaf margins of the specimens seen are denticulate, with the teeth apparently scabrosities rather than dentate mesophyll tissue.

**8. *Wendlandia formosana*** Cowan, *Notes Roy. Bot. Gard. Edinburgh* 16: 247. 1932.

水金京 *shui jin jing*

Shrubs or trees, 2–8 m tall; branches flattened to terete, densely puberulent to glabrescent, reddish brown to gray. Leaves opposite; petiole 0.7–2.5 cm, thinly puberulent or glabrous; blade drying papery, elliptic or elliptic-lanceolate, 6–14 × 2–6.5 cm, both surfaces glabrescent or sparsely to densely puberulent or strigillose at least on principal veins, base acute to obtuse, apex acute to acuminate; secondary veins 5–10 pairs; stipules generally persistent, broadly triangular, 2–3.5 mm, densely strigillose to puberulent, apex erect, acute, cuspidate, or sometimes narrowly spatulate. Inflorescences paniculate, pyramidal in outline, 12–20 × 10–20 cm, branched to 2 or 3 orders, densely puberulent to strigillose, sessile and tripartite or pedunculate; peduncle 2–4 cm; bracts linear, spatulate, or narrowly elliptic, 1–6 mm; pedicels 0.5–4 mm. Flowers subsessile to pedicellate. Calyx glabrous; hypanthium portion subglobose, ca. 0.8 mm; limb lobed nearly to base; lobes triangular, 0.3–0.5 mm, sometimes ciliate. Corolla white to yellow, funnelform, glabrous outside; tube 1.5–4 mm, villosulous in throat; lobes spatulate, 1.5–2.5 mm. Filaments ca. 0.8 mm; anthers linear-lanceolate, ca. 2 mm, partially exerted. Stigma 2-lobed, ca. 0.8 mm. Capsules globose, 1.8–2 × 2–2.2 mm, glabrous. Fl. Apr–Jun, fr. May–Dec.

Thickets or forests at low elevations or on hills or mountains; 200–1600 m. Guangdong, Guangxi, Taiwan, Yunnan [Japan (Ryukyu Islands), Vietnam].

- 1a. Leaf secondary veins 7–10 pairs, closely set, usually prominent abaxially; corolla 3–5 mm, with tube slightly longer than lobes ..... 8a. subsp. *breviflora*
- 1b. Leaf secondary veins 5–9 pairs, rather well spaced, prominulous abaxially; corolla 5–6.5 mm, with tube markedly longer than lobes ..... 8b. subsp. *formosana*

**8a. *Wendlandia formosana* subsp. *breviflora*** F. C. How, Sunyatsenia 7(1–2): 38. 1948.

短花水金京 duan hua shui jin jing

Leaf secondary veins 7–10 pairs, closely set, usually prominent abaxially. Corolla tube 1.5–3 mm, lobes 1.5–2 mm. Fl. Apr–Jun, fr. May–Dec.

Thickets or forests on hills or mountains; 200–1600 m. Guangdong, Guangxi, Yunnan [Vietnam].

**8b. *Wendlandia formosana* subsp. *formosana***

水金京(原亚种) shui jin jing (yuan ya zhong)

Secondary veins 5–7 pairs in leaves of flowering branches, 5–9 pairs in leaves of vegetative branches (*Tsang 23991*, MO), rather well spaced, prominulous abaxially. Corolla tube 3–4 mm; lobes 2–2.5 mm. Fl. Apr–Jun, fr. Jun–Aug.

Forests on hills at low elevations; 200–500 m. Taiwan [Japan (Ryukyu Islands)].

**9. *Wendlandia grandis*** (J. D. Hooker) Cowan, Notes Roy. Bot. Gard. Edinburgh 16: 261. 1932.

西藏水锦树 xi zang shui jin shu

*Wendlandia tinctoria* (Roxburgh) Candolle var. *grandis* J. D. Hooker, Fl. Brit. India 3: 38. 1880.

Trees, 3–4 m tall; branches brown, fissured, strigillose to glabrescent. Leaves opposite; petiole 0.5–1.5 cm, strigillose; blade drying leathery or thickly papery, elliptic, elliptic-oblong, or obovate-oblong, 5–17 × 2.5–7 cm, adaxially glabrous or sparsely strigillose, abaxially glabrous or sparsely pubescent on lamina, sparsely hispidulous along veins, and with pubescence denser along midrib, base cuneate or acute, apex acute or shortly acuminate; secondary veins 8–12 pairs; stipules generally persistent, triangular to ovate, 9–12 mm, strigillose, apex erect to spreading, ligulate, 5–7 mm, often longitudinally folded. Inflorescences paniculate, ovoid, 9–17 × 5–15 cm, densely brown hirsute; bracts lanceolate, ca. 5 mm. Flowers sessile. Calyx densely brown hirtellous; hypanthium portion ca. 1 mm; limb deeply lobed; lobes lanceolate, 0.5–1 mm. Corolla white, funnelform, glabrous outside; tube ca. 4 mm, white hirsute inside; lobes triangular, 1–1.2 mm. Anthers elliptic, ca. 0.8 mm, sessile, partially exerted. Stigma 2-lobed. Capsules subglobose, ca. 2 mm in diam., pubescent. Fl. and fr. Aug.

Evergreen forests, secondary forests; 700–1300 m. Xizang (Mé-dog) [Bangladesh, Bhutan, India, Myanmar, Nepal].

Springate et al. (Fl. Bhutan 2(2): 754. 1999) described the leaf size of plants from Bhutan as 10–24 × 5–11 cm and the corolla tubes there as 2.5–5 mm; these measurements might be found in Chinese plants.

**10. *Wendlandia guangdongensis*** W. C. Chen, Acta Phytotax. Sin. 21: 393. 1983.

广东水锦树 guang dong shui jin shu

Shrubs or trees, 4–6 m tall; branches terete, moderately to densely hirsute. Leaves opposite; petiole 0.3–1.2 cm, moderately to densely hirtellous; blade drying thickly papery, lanceolate-oblong or ovate-elliptic, 7–16 × 3–8.5 cm, adaxially

sparsely strigillose or puberulent to glabrescent on lamina and moderately to densely strigillose or hirtellous on principal veins, abaxially sparsely to moderately hirtellous throughout, base rounded to obtuse, apex obtuse, shortly acuminate, or acute; secondary veins 7–11 pairs; stipules generally persistent, pandurate, 5–6 × 4–6 mm, glabrescent, with upper part spreading to reflexed, apex rounded to obtuse. Inflorescences paniculate, branched to 2 or 3 orders, 13–17 × 10–20 cm, densely hirtellous to hirsute, pedunculate; peduncle 1–2 cm; bracts narrowly elliptic to oblanceolate, 1.5–3 mm. Flowers sessile in glomerules. Calyx glabrous; hypanthium portion subglobose, ca. 0.8 mm; limb divided nearly to base; lobes lanceolate or narrowly oblong, 1.2–2 mm, sparsely to densely ciliate. Corolla white or greenish yellow, tubular to salverform, glabrous outside; tube 2–3.5 mm, in throat white hirsute; lobes suborbicular, ca. 1 mm. Anthers elliptic, ca. 0.7 mm, sessile, partially exerted. Stigma 2-lobed, ca. 0.3 mm. Capsules subglobose, ca. 1.5 mm in diam., glabrous. Fl. Mar–Apr, fr. May.

• Thickets or forests in ravines or on hill slopes; 100–800 m. Guangdong, Hainan.

The ciliate filaments on the margins of the calyx lobes give the appearance of pilose pubescence on all of the calyx at first glance, but when teased apart the individual hypanthia on the material seen are completely glabrous.

**11. *Wendlandia jingdongensis*** W. C. Chen, Acta Phytotax. Sin. 21: 396. 1983.

景东水锦树 jing dong shui jin shu

Shrubs, ca. 3 m tall; branches pubescent. Petiole 0.7–1 cm, pubescent; leaf blade drying leathery, lanceolate-elliptic, 7–10.5 × 2–4 cm, adaxially glabrous or sparsely puberulent along veins, abaxially sparsely pubescent along veins and glabrous on lamina, base cuneate or acute, apex acuminate; secondary veins 7 or 8 pairs; stipules pandurate, as wide as or wider than branchlets, apex erect, rounded. Inflorescences 9–15 × 10–15 cm, densely brown hirsute. Flowers sessile. Calyx pubescent; lobes lanceolate. Corolla pale yellow, glabrous outside; tube 2.5–3 mm, white hirsute inside; lobes ca. 0.5 mm. Anthers elliptic, ca. 0.6 mm, sessile, partially exerted. Stigma bifid. Capsules subglobose, ca. 1.5 mm in diam., densely pubescent. Fl. and fr. May.

• Forests on mountains; ca. 1700 m. Yunnan (Jingdong).

**12. *Wendlandia laxa*** S. K. Wu ex W. C. Chen, Acta Phytotax. Sin. 21: 390. 1983.

疏花水锦树 shu hua shui jin shu

Small trees, 5–8 m tall; branches mealy puberulent. Petiole 0.7–1.5 cm, glabrescent; leaf blade drying papery to thinly leathery, lanceolate-elliptic to elliptic, 4.5–13 × 2–5 cm, both surfaces glabrous throughout or puberulent on principal veins, base acute to obtuse, apex acute to shortly acuminate; secondary veins 6 or 7 pairs; stipules persistent, broadly triangular, 2.4–4.5 mm, glabrescent, apex erect, cuspidate. Inflorescences paniculate, pyramidal, 13–22 × 12–18 cm, densely puberulent; pedicels 2–4.5 mm. Flowers pedicellate. Calyx puberulent to glabrous; hypanthium portion turbinate; limb lobed nearly to

base; lobes ovate. Corolla white, tubular-salverform, outside puberulent to glabrous; tube 3.5–4 mm, sparsely puberulent inside; lobes subrounded, ca. 1 mm. Anthers elliptic, ca. 0.8 mm, partially exserted. Stigma 2-lobed. Capsules subglobose, glabrescent. Fl. Nov, fr. Jul, Dec.

- Mixed forests; 500–1000 m. Yunnan (Jingdong).

**13. *Wendlandia ligustrina*** Wallich ex G. Don, Gen. Hist. 3: 518. 1834.

小叶水锦树 xiao ye shui jin shu

Shrubs, 1.5–3 m tall; branches flattened to quadrangular, strigillose to glabrescent. Leaves opposite; petiole 0.8–1.5 cm, strigillose to glabrescent; blade drying leathery, dark brown adaxially, reddish brown abaxially, elliptic or elliptic-ovate, 3–12 × 1.5–6 cm, adaxially glabrous, abaxially glabrescent to sparsely strigillose or puberulent at least along principal veins, base cuneate and sometimes shortly decurrent, apex acute or obtuse; secondary veins 6–8 pairs; stipules generally persistent, broadly triangular, 2–3 mm, strigillose to glabrescent, apex erect, cuspidate. Inflorescences paniculate, pyramidal, 15–17 × 12–20 cm, branched to 2 or 3 orders, densely hirtellous to strigillose, sessile and tripartite or pedunculate; peduncle 2–3 cm; bracts 1.5–6 mm; pedicels to 1 mm. Flowers sessile to shortly pedicellate. Calyx moderately to sparsely strigillose; hypanthium portion ellipsoid, ca. 1 mm; limb lobed nearly to base; lobes narrowly triangular to linear, 1–1.5 mm, generally unequal on an individual flower. Corolla yellow or pale yellowish green, salverform to tubular-funnelform, glabrous outside; tube 3.5–5 mm, pilose in throat; lobes narrowly oblong to spatulate, 1.5–2.2 mm. Filaments ca. 1 mm; anthers linear-lanceolate, 1.2–1.5 mm, partially exserted. Stigma 2-lobed, ca. 1 mm. Capsules subglobose, ca. 2 mm, strigillose. Fl. Jun–Feb of following year.

Forests in valleys; 1500–1600 m. Guizhou (Qinglong), Yunnan [Myanmar].

**14. *Wendlandia litseifolia*** F. C. How, Sunyatsenia 7(1–2): 46. 1948.

木姜子叶水锦树 mu jiang zi ye shui jin shu

Trees, ca. 10 m tall; branches terete to subquadrangular, densely brown hirtellous to glabrescent. Leaves opposite; petiole 0.5–1.2 cm, densely hirtellous to strigillose; blade drying subleathery, obovate, obovate-elliptic, or rarely elliptic, 6.4–11.5 × 3–6.5 cm, adaxially sparsely hispidulous to puberulent with pubescence denser along midrib, abaxially sparsely to moderately strigillose or hirtellous with pubescence denser along veins, base obtuse, apex acute to abruptly and shortly acuminate; secondary veins 6–8 pairs, plane to hardly visible abaxially; stipules generally persistent, pandurate, 3–5 × 1.5–2 mm, densely strigillose, apex suberect to spreading, subrounded. Inflorescences paniculate, 7–10 × 4–5 cm, branched to 2 or 3 orders, dark yellow- to reddish brown tomentose to hirtellous, pedunculate; peduncle 0.5–0.8 cm; bracts linear to narrowly elliptic, 1–3 mm. Flowers sessile, densely grouped. Calyx densely hirtellous; hypanthium portion subglobose, ca. 0.8 mm; limb lobed nearly to base; lobes triangular to ovate, ca. 0.5 mm. Corolla pale yellow, tubular-funnelform, glabrous outside; tube 2.5–3 mm, sparsely pilose in throat; lobes ovate, ca. 1 mm.

Anthers elliptic, ca. 0.7 mm, subsessile, partially exserted. Stigma 2-lobed, ca. 0.2 mm. Capsules subglobose to ovoid, ca. 2 × 2 mm, hirtellous. Fl. and fr. Jun.

- Forests on mountains or hills; ca. 800 m. Guangxi (Tianlin).

This species was included by How (loc. cit.) and W. C. Chen (Acta Phytotax. Sin. 21: 391. 1983) in the group of *Wendlandia* species with erect, triangular, acute stipules; but examination of an isotype (MO!) and careful study of the protologue (including the figure) shows that the stipules are oblanceolate to pandurate, with the apex narrow but mostly not spreading from the stem on most nodes.

**15. *Wendlandia longidens*** (Hance) Hutchinson in Sargent, Pl. Wilson. 3: 392. 1916.

水晶榦子 shui jing ke zi

*Hedyotis longidens* Hance, J. Bot. 20: 289. 1882; *Wendlandia henryi* Oliver.

Subshrubs, much branched, 0.2–1.5 m tall; branches terete, densely strigillose, hirtellous, or hispidulous. Leaves opposite; petiole 0.5–2 mm, strigillose to hirtellous; blade drying papery, elliptic-lanceolate, lanceolate, narrowly lanceolate, or ovate, 0.8–3 × 0.3–1 cm, adaxially densely hispidulous to glabrous, abaxially densely to sparsely hispidulous or strigillose or glabrous, base acute and usually decurrent, apex acute to shortly acuminate or rarely obtuse; secondary veins ca. 3 pairs, occasionally with foveolate pilosulous domatia; stipules lanceolate, triangular, or ovate-triangular, 2.5–4.5 mm, densely strigillose to hispidulous, apex erect to spreading, acute to cuspidate. Inflorescence paniculate to cymose, corymbiform to subglobose, 2–4 × 2–4 cm, densely strigillose, hirtellous, or strigose, sessile and tripartite or pedunculate; peduncle 3–6 mm; bracts linear to narrowly triangular, 0.5–5 mm; pedicels 2–3 mm. Flowers pedicellate. Calyx densely strigillose to glabrescent; hypanthium portion turbinate to ellipsoid, 1–2 mm; limb lobed nearly to base; lobes linear-oblong to spatulate or oblanceolate, 2–3 mm. Corolla white, tubular-salverform, glabrous outside; tube 7–8 mm; lobes linear-oblong, 7–8 mm. Filaments 5–6 mm; anthers linear-lanceolate, 3–3.2 mm, exserted. Stigma 2-lobed, ca. 2 mm. Capsule subglobose, 2–2.5 mm in diam., densely strigillose to glabrescent, with calyx lobes elongating, up to 4 mm. Fl. May–Jul, fr. Jul–Nov.

- Thickets at riversides or on mountain slopes; near sea level to 1800 m. Guizhou (Chishui), Hubei (Yichang), Sichuan, Yunnan.

**16. *Wendlandia longipedicellata*** F. C. How, Sunyatsenia 7(1–2): 39. 1948.

长梗水锦树 chang geng shui jin shu

Shrubs, ca. 1.5 m tall; branchlets ferruginous pubescent. Leaves opposite; petiole 0.5–1 cm, glabrous or sparsely pubescent; blade drying leathery, elliptic or lanceolate-elliptic, 4–8 × 0.8–2 cm, adaxially glabrous, abaxially sparsely pubescent along midrib, base acute and usually decurrent, apex acute; secondary veins not easily visible; stipules generally persistent, broadly triangular, 1.5–3 mm, apex erect, acute. Inflorescence paniculate, lax, pyramidal, 6–10.5 × 4.5–10.5 cm, ferruginous pilosulous, sessile and tripartite or pedunculate; peduncle 1.8–3.6 cm; pedicels 3–6 mm. Flowers pedicellate. Calyx sparsely

pilosulous or glabrous; hypanthium portion subglobose, ca. 1.75 mm; limb lobed nearly to base; lobes triangular, ca. 0.75 mm. Corolla purplish red, tubular-salverform, glabrous outside; tube 2.3–3 mm, sparsely strigillose inside; lobes narrowly oblong to spatulate, 1.7–2 mm. Anthers linear-lanceolate, ca. 1.2 mm, subsessile, partially exerted. Stigma 2-lobed, ca. 0.5 mm. Capsules not seen. Fl. Feb.

- Forests on mountains; ca. 1600 m. Yunnan (Luxi).

**17. *Wendlandia luzoniensis*** Candolle, Prodr. 4: 412. 1830.

吕宋水锦树 lü song shui jin shu

*Wendlandia luzoniensis* var. *membranifolia* (Elmer) Cowan; *W. membranifolia* Elmer.

Shrubs or small trees; branches flattened-quadrate, glabrous to sparsely strigillose. Leaves opposite; petiole 0.8–1.2 cm, glabrous to sparsely strigillose; blade drying papery, ovate-oblong or elliptic, 10–20 × 4.5–7 cm, glabrous on both surfaces or sparsely strigillose on principal veins abaxially, base cuneate to acute, apex acute to shortly acuminate; secondary veins 6–9 pairs; stipules generally persistent, suborbicular, obovate, oblanceolate, or pandurate, 4–6 × 1–3 mm, glabrous or sparsely strigillose, apex erect to spreading, obtuse to rounded. Inflorescences paniculate, pyramidal to broadly obconic in outline, branched to 3 or 4 orders, 10–12 × 12–15 cm, densely strigillose to hirtellous, pedunculate; peduncle 0.8–1 cm; bracts linear to narrowly lanceolate, 0.5–2 mm. Flowers sessile or subsessile. Calyx with hypanthium portion subglobose, 1–1.5 mm, densely puberulent to strigillose; limb deeply lobed; lobes triangular to lanceolate, 0.5–1 mm, glabrous. Corolla white, tubular or tubular-funnelform, glabrous outside; tube 3–4 mm, villosulous in throat; lobes ovate, 0.8–1.5 mm. Anthers elliptic, ca. 1 mm, subsessile, partially exerted. Stigma 2-lobed, ca. 0.3 mm. Capsules subglobose, 1.5–2 mm in diam., moderately to sparsely strigillose. Fl. and fr. Jul–Aug.

- Forests. Taiwan (Taidong) [?India, Philippines, ?Vietnam].

*Wendlandia membranifolia* was cited by W. C. Chen (in FRPS 71(1): 214. 1999) as a synonym of *W. luzoniensis*, apparently based on Cowan's 1932 treatment (Notes Roy. Bot. Gard. Edinburgh 16: 294. 1932). However, Cowan subsequently (Notes Roy. Bot. Gard. Edinburgh 18: 187. 1934) separated these plants as *W. luzoniensis* var. *membranifolia*; because of the inclusion of the name *W. membranifolia*, this other name is here added too.

**18. *Wendlandia merrilliana*** Cowan, Notes Roy. Bot. Gard. Edinburgh 18: 303. 1935.

海南水锦树 hai nan shui jin shu

Shrubs or rarely trees, 1–3(–12) m tall; branches terete to somewhat flattened or quadrangular, sparsely strigillose or pilosulous to usually glabrous. Leaves opposite; petiole 1–6 mm, glabrous; blade drying leathery or subleathery, adaxially pale green to dark gray-green, abaxially rather pale or reddish brown to dark purple-gray or purple-black, elliptic-oblong, oblong-lanceolate, oblanceolate, or elliptic, 3–14.5 × 0.8–5 cm, glabrous on both surfaces, base cuneate to rounded, truncate, or cordulate, apex acute to acuminate; secondary veins 5–9 pairs; stip-

ules caducous or persistent, spatulate, lanceolate, or leaflike, 1–10 mm, glabrous, apex erect to spreading, acute. Inflorescence cymose to paniculate, narrowly pyramidal, 1.5–10 × 1.5–6.6 cm, branched to 2 orders, puberulent to glabrescent, pedunculate; peduncle 0.3–3 cm; bracts linear, lanceolate, or spatulate, 0.3–3 mm; pedicels 2–3.5 mm. Flowers pedicellate. Calyx glabrous; hypanthium portion subglobose to ellipsoid, 1.5–2 mm; limb deeply lobed; lobes triangular, 0.5–1 mm. Corolla white, salverform, glabrous outside; tube 5–8 mm, pilose in throat; lobes narrowly oblong, 5–6 mm. Filaments 4–4.5 mm; anthers linear-lanceolate, 3–3.3 mm, exerted. Stigma 2-lobed, 1.5–2 mm. Capsules red or purplish black, subglobose to ovoid, 2–3 × 2.5–3.5 mm, glabrous. Fl. and fr. Apr to Jan of following year.

- Open spaces or streamsides and rocks in forests on mountains; 400–1400 m. Hainan.

This species was included by Cowan in a group of generally similar species that are all reduced shrubs, but it apparently becomes rather large compared to the other species; also its stipules are anomalous in the group, as the other species otherwise have very narrow triangular stipules.

- 1a. Branch internodes 0.5–7 cm; leaves larger, 4.5–14.5 × 1.5–5 cm; stipules 4–10 mm, spatulate, lanceolate, or leaflike ..... 18a. var. *merrilliana*
- 1b. Branch internodes 0.4–2.2 cm; leaves smaller, 3–5 × 0.8–1.5 cm; stipules 1–4 mm, spatulate to lanceolate ..... 18b. var. *parvifolia*

**18a. *Wendlandia merrilliana* var. *merrilliana***

海南水锦树(原变种) hai nan shui jin shu (yuan bian zhong)

Branch internodes 0.5–7 cm. Leaves 4.5–14.5 × 1.5–5 cm; stipules spatulate, lanceolate, or leaflike, 4–10 mm. Fl. and fr. Apr to Jan of following year.

- Open spaces or streamsides and rocks in forests on mountains; 400–1400 m. Hainan.

**18b. *Wendlandia merrilliana* var. *parvifolia*** F. C. How, Sunyatsenia 7(1–2): 61. 1948.

细叶海南水锦树 xi ye hai nan shui jin shu

Branch internodes 0.4–2.2 cm. Leaves 3–5 × 0.8–1.5 cm; stipules spatulate to lanceolate, 1–4 mm. Fr. Oct.

- On rocks, infrequent. Hainan (Dongfang).

**19. *Wendlandia myriantha*** F. C. How, Sunyatsenia 7(1–2): 57. 1948.

密花水锦树 mi hua shui jin shu

Shrubs, ca. 3 m tall; branches terete to subquadrangular, brown strigillose. Leaves opposite; petiole 0.7–1.2 cm, puberulent; blade drying subleathery, elliptic, 7–12 × 2.5–6 cm, adaxially glabrescent or sparsely puberulent along midrib, abaxially puberulent, base cuneate, margin sparsely ciliolate, apex shortly acuminate; secondary veins 8–10 pairs; stipules generally persistent, ovate to pandurate, ca. 7 mm, sparsely puberulent, apex spreading to reflexed, rounded to 2-lobed. Inflorescences panic-

ulate, branched to 2–4 orders, 18–20 × 18–20 cm, puberulent, sessile and tripartite or pedunculate; peduncle 3–4 cm; lower bracts leaflike, upper bracts linear-lanceolate, oblong, oblong-lanceolate, or oblanceolate, 2–6 mm, strigillose. Flowers sessile in fasciculate groups. Calyx glabrous or sparsely puberulent; hypanthium portion subglobose, ca. 2 mm; limb lobed nearly to base; lobes ovate or ovate-triangular, ca. 1.5 mm. Corolla white, tubular-funnelform, glabrous outside; tube ca. 4 mm, in throat white hirsute; lobes ovate, ca. 1 mm. Anthers elliptic, ca. 1 mm, subsessile, partially exserted. Stigma 2-lobed. Capsules not seen. Fl. Mar.

- Forests in ravines; ca. 300 m. Guangxi (Shangsi).

**20. *Wendlandia oligantha*** W. C. Chen, Acta Phytotax. Sin. 21: 399. 1983.

龙州水锦树 long zhou shui jin shu

Shrubs or trees, 3–10 m tall; branches flattened to quadrangular, grayish brown, glabrous or sparsely or densely puberulent to pilosulous becoming glabrescent. Leaves opposite; petiole 3–15 mm, glabrous or mealy puberulent; blade drying leathery, adaxially dark brown and often shiny, elliptic, ovate, or ovate-oblong, 3–10.5 × 1.5–5 cm, adaxially glabrous, abaxially glabrous or sparsely to densely strigillose or puberulent along principal veins, base cuneate or acute, apex acute or shortly acuminate; secondary veins 5–7 pairs, hardly visible abaxially; stipules deciduous, spatulate to pandurate, 1.5–2.5 mm, pilosulous or puberulent, apex spreading to reflexed, rounded to obtuse. Inflorescences laxly paniculate, branched to 2 or 3 orders, 7–20 × 4–18 cm, moderately to densely pilosulous, sessile and tripartite or pedunculate; peduncle 0.5–1.5 cm; bracts linear, narrowly oblanceolate, or triangular, 1–5 mm. Flowers sessile to subsessile. Calyx glabrous to sparsely strigillose; hypanthium portion subglobose, ca. 0.5 mm; limb lobed nearly to base; lobes triangular to lanceolate, 0.3–0.5 mm. Corolla white, salverform to funnelform, outside glabrous; tube ca. 2.5 mm, rather abruptly narrowed at base, sparsely villous in throat; lobes triangular, ca. 1 mm. Anthers elliptic, ca. 0.7 mm, subsessile, partially exserted. Stigma 2-lobed, ca. 0.2 mm. Capsules subglobose, ca. 1.5 mm in diam., glabrous. Fl. Jul–Aug, fr. Aug–Dec.

- Rocks in forests or thickets in valleys; 300–1000 m. Guangxi.

**21. *Wendlandia parviflora*** W. C. Chen, Acta Phytotax. Sin. 21: 394. 1983.

小花水锦树 xiao hua shui jin shu

Small trees, 4–5 m tall; branches ferruginous pubescent. Leaves opposite; petiole 0.8–1.5 cm, densely ferruginous pubescent; blade drying leathery, elliptic-oblong or ovate-elliptic, 8.5–17 × 4.5–8.5 cm, adaxially sparsely strigose except densely ferruginous pubescent along veins, abaxially densely ferruginous pubescent, base cuneate, acute, or sometimes obtuse, apex acuminate; secondary veins 8–13 pairs; stipules pandurate, 4–5 mm wide, pilosulous, apex spreading to reflexed. Inflorescences paniculate, ca. 19 × 15 cm, ferruginous pubescent; bracts ovate, ca. 1 mm. Flowers sessile. Calyx glabrous or pilose; hypanthium portion ca. 0.8 mm; limb deeply lobed; lobes semiorbicular, ca. 0.5 mm. Corolla pale green, outside glabrous; tube

1–1.5 mm, white hirsute in throat; lobes ca. 1 mm. Anthers elliptic, ca. 0.5 mm, subsessile, partially exserted. Stigma 2-lobed. Capsules not seen. Fl. Dec.

- Forests on flat land. Yunnan (Mengla).

**22. *Wendlandia pendula*** (Wallich) Candolle, Prodr. 4: 412. 1830.

垂枝水锦树 chui zhi shui jin shu

*Rondeletia pendula* Wallich in Roxburgh, Fl. Ind. 2: 140. 1824.

Shrubs, often straggly, 1–3 m tall; branches pendulous, terete, hispidulous or puberulent to glabrescent. Leaves opposite or ternate, subsessile; blade drying papery, ovate-lanceolate or ovate, 3.5–10 × 1.8–4 cm, adaxially glabrous to sparsely hispidulous, abaxially sparsely to moderately scaberulous or hispidulous with pubescence denser on principal veins, base rounded to cuneate, apex acute to weakly acuminate; secondary veins 4–7 pairs; stipules caducous to persistent, triangular, 1.5–2 mm, glabrescent, apex erect, cuspidate. Inflorescences paniculate, pyramidal in outline, 10–15 × 4–9 cm, branched to 2 or 3 orders, densely hispidulous to puberulent, sessile and tripartite or pedunculate; peduncle 2–4.5 cm; bracts triangular to ovate, 0.5–1 mm; pedicels 0.5–1.2 mm. Flowers shortly pedicellate. Calyx puberulent to glabrous; hypanthium ellipsoid to subglobose, 1–1.5 mm; limb lobed nearly to base; lobes lanceolate or triangular, 0.5–0.8 mm. Corolla red, tubular-funnelform, outside glabrous; tube 4–5 mm, inside pubescent in upper part; lobes oblong to elliptic, ca. 2 mm. Anthers linear-oblong, 1.3–1.5 mm, partially exserted. Stigmas clavate, ca. 1.3 mm. Capsules subglobose, 1.5–2 mm in diam., glabrous or pilose. Fl. and fr. Dec–Feb of following year.

Forests or thickets in ravines; 600–1300 m. Yunnan [Bhutan, India, Myanmar, Nepal].

W. C. Chen (in FRPS 71(1): 221. 1999) described the stipules as caducous, but these are persistent on all the specimens studied.

**23. *Wendlandia pingpienensis*** F. C. How, Sunyatsenia 7(1–2): 51. 1948.

屏边水锦树 ping bian shui jin shu

Shrubs or trees, 3–15 m tall. Petiole 1–3 cm, sparsely strigillose; leaf blade drying papery, elliptic-oblong or oblanceolate-oblong, 7.5–23 × 4–8 cm, adaxially glabrous or sometimes sparsely hispidulous along midrib, abaxially glabrous or sparsely hispidulous along principal veins, base cuneate or attenuate, apex acute or shortly caudate; secondary veins 7–13 pairs; stipules ca. 2 × as wide as branchlets, apex reflexed, subrounded. Inflorescences laxly paniculate, to 30 × 24 cm, ferruginous strigillose. Flowers sessile. Calyx pilosulous to strigillose; hypanthium portion subglobose, 1–1.5 mm; limb deeply lobed; lobes triangular. Corolla white, funnelform, glabrous outside; tube 4–5 mm, white hirsute inside upper part; lobes triangular, ca. 1 mm. Anthers elliptic, ca. 1 mm, subsessile, partially exserted. Stigma 2-lobed. Capsules subglobose, 1.5–2 mm in diam., pubescent or subglabrous. Fl. Apr–Oct, fr. Jun–Nov.

- Forests or thickets in valleys; 200–1500 m. Yunnan.

**24. *Wendlandia pubigera*** W. C. Chen, Acta Phytotax. Sin. 21: 395. 1983.

大叶木莲红 da ye mu lian hong

Shrubs, to 2 m tall; branches pubescent. Leaves opposite or ternate; petiole 0.8–1.8 cm, pubescent; blade drying thinly leathery, obovate-oblong or elliptic, 14.5–18 × 6–7 cm, adaxially glabrous or sparsely puberulent along principal veins, abaxially sparsely pubescent with pubescence denser along principal veins, base cuneate, apex shortly acuminate; secondary veins 10 or 11 pairs; stipules generally persistent, pandurate, 7.5–9 × 2.5–3 mm, nearly as wide as to slightly wider than branches, apex spreading, rounded. Inflorescence paniculate, pyramidal in outline, ca. 12 × 12–15 cm, branched to 2 or 3 orders, yellowish brown pubescent, sessile and tripartite or pedunculate; peduncle 1.8–3 cm. Flowers sessile. Calyx pubescent; hypanthium portion ca. 1.8 mm; limb lobed nearly to base; lobes ovate to deltoid, ca. 1 mm. Corolla white, tubular-salverform, outside glabrous; tube 2–3 mm, white villous inside upper part; lobes rounded to spatulate, ca. 1 mm. Anthers elliptic, ca. 0.7 mm, subsessile, partially exserted. Stigma 2-lobed. Capsules not seen. Fl. Mar.

- Dense forests. Guangxi (Shangsi).

Some of the characters in the description here are augmented with details from the protologue figure.

**25. *Wendlandia salicifolia*** Franchet ex Drake, J. Bot. (Morot) 9: 208. 1895.

柳叶水锦树 liu ye shui jin shu

*Ligustrum thea* H. Léveillé & Dunn.

Shrubs, to ca. 1 m tall; branches flattened to terete, hirtellous or strigillose to glabrescent. Leaves opposite; petiole 0.5–3 mm; blade drying thinly leathery, narrowly lanceolate to narrowly elliptic, 2–6.5 × 0.4–1.2 cm, glabrous on both surfaces or sparsely pubescent along midrib abaxially, base acute, margin usually edged with thickened vein, apex acute to weakly acuminate; secondary veins 5–7 pairs; stipules generally persistent, triangular, 1.5–4 mm, densely strigillose to hirtellous, apex erect, acute to aristate. Inflorescences paniculate, pyramidal in outline, 2–5 × 1–3 cm, branched to 2 or 3 orders, densely hirtellous to strigillose, sessile and tripartite or pedunculate; peduncle 0.4–0.7 cm; bracts linear, 1–5 mm; pedicels 0.3–1 mm. Flowers subsessile to pedicellate. Calyx moderately to sparsely strigillose; hypanthium portion ellipsoid to subglobose, ca. 0.8 mm; limb lobed nearly to base; lobes triangular, 0.3–0.5 mm. Corolla pale reddish white, funnellform, glabrous outside; tube 2–5 mm, apparently pubescent inside upper part; lobes linear-oblong, 2–2.5 mm. Filaments ca. 1 mm; anthers linear-lanceolate, ca. 1.4 mm, partially exserted. Stigma 2-lobed, 0.8–1 mm. Capsules subglobose to ovoid, ca. 1.5 × 2 mm, moderately to sparsely strigillose. Fl. Nov, fr. Jan of following year.

Streamsides in ravines and forests on hill slopes; 100–200 m. Guangxi (Donglan), Guizhou (Guanling), Yunnan [Laos, Vietnam].

**26. *Wendlandia scabra*** Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 41: 310. 1872.

粗叶水锦树 cu ye shui jin shu

Shrubs or trees, 1–12 m tall; branches terete to quadrangular, densely brown hirtellous to -tomentose. Leaves opposite; petiole 0.5–2.7 cm, densely brown tomentulose to -hirtellous; blade drying papery or leathery, elliptic-obovate, elliptic, or ovate, 6.5–18 × 2.8–9 cm, adaxially sparsely to moderately scaberulous on lamina and densely strigillose to tomentulose on principal veins, abaxially sparsely to densely strigillose, pilosulous, hirtellous, strigose, or pilose, base obtuse, acute, or rounded, apex acute or acuminate; secondary veins 6–10 pairs; stipules generally persistent, spatulate to pandurate, 5–6 mm, strigillose or tomentulose to glabrescent, apex spreading, obtuse. Inflorescences paniculate, pyramidal, 20–30 × 20–25 cm, branched to 2 or 3 orders, erect and congested (var. *scabra*, var. *pilifera*) or pendulous and lax (var. *dependens*), densely hirtellous to tomentose, pedunculate; peduncle ca. 4 cm; bracts linear, 1–2.5 mm. Flowers sessile or subsessile. Calyx densely hirtellous; hypanthium portion turbinate to ellipsoid, ca. 0.5 mm; limb deeply lobed; lobes triangular, 0.5–0.8 mm. Corolla white, tubular-funnelform, glabrous outside or pubescent on lobes (var. *pilifera*); tubes 2.5–3 mm, inside glabrous or sparsely pubescent in lower part (var. *scabra*, var. *dependens*) or white villous or hispid in upper part (var. *pilifera*); lobes oblong, 1–1.25 mm. Anthers elliptic, 0.75–1 mm, subsessile, partially exserted. Stigma 2-lobed, ca. 0.7 mm. Capsules subglobose, ca. 2 mm in diam., hirsute. Fl. Mar–May, fr. May–Jul.

Forests or thickets on mountains; 100–1800 m. Guangxi, Guizhou, Yunnan [Bangladesh, India, Myanmar, Nepal, Thailand, Vietnam].

The application of this name and the report of this species seem to be based on Cowan's incorporation of Kurz's report into his treatment and may deserve re-evaluation.

- 1a. Leaves densely strigillose or scaberulous adaxially, densely tomentulose abaxially ..... 26c. var. *scabra*
- 1b. Leaves glabrescent adaxially, sparsely strigose or pilose abaxially.
  - 2a. Leaves sparsely strigose abaxially; inflorescences lax, pendulous; corolla tubes inside glabrous or pubescent near middle ..... 26a. var. *dependens*
  - 2b. Leaves pilose abaxially; inflorescences compact, erect; corolla tubes inside white villous or hispid in upper part ..... 26b. var. *pilifera*

**26a. *Wendlandia scabra* var. *dependens*** Cowan, Notes Roy. Bot. Gard. Edinburgh 16: 292. 1932.

悬花水锦树 xuan hua shui jin shu

Leaves glabrescent adaxially, sparsely strigose abaxially. Inflorescence lax, pendulous. Corolla tube inside glabrous or pubescent near middle; lobes glabrous outside. Fl. Mar–Apr.

- Forests or thickets on mountains; 500–1800 m. W Yunnan.

**26b. *Wendlandia scabra* var. *pilifera*** F. C. How ex W. C. Chen, Acta Phytotax. Sin. 21: 395. 1983.

毛粗叶水锦树 mao cu ye shui jin shu

Leaves glabrescent adaxially, pilose abaxially. Inflorescence compact, erect. Corolla tube white villous in upper part inside; lobes pubescent outside. Fl. Apr.

- Thickets on mountains. Guangxi (Shangsi).

**26c. *Wendlandia scabra* var. *scabra***

粗叶水锦树(原变种) cu ye shui jin shu (yuan bian zhong)

*Wendlandia paniculata* (Roxburgh) Candolle subsp. *scabra* (Kurz) Cowan; *W. zooi* F. C. How.

Leaves strigillose and/or scaberulous adaxially, tomentulose abaxially. Inflorescence erect, compact. Corolla tube inside sparsely pubescent in lower part or glabrous; lobes glabrous outside. Fl. Apr–May, fr. May–Jul.

Forests or thickets on mountains; 100–1600 m. Guangxi, Guizhou, Yunnan [Bangladesh, India, Myanmar, Nepal, Thailand, Vietnam].

**27. *Wendlandia speciosa* Cowan, Notes Roy. Bot. Gard. Edinburgh 16: 254. 1932.**

美丽水锦树 mei li shui jin shu

*Wendlandia speciosa* var. *forrestii* Cowan.

Shrubs or trees, 1–12 m tall; branches flattened, strigillose to glabrescent. Leaves opposite; petiole 0.5–3 cm, strigillose to glabrescent; blade drying papery or subleathery, ovate, obovate, ovate-lanceolate, or elliptic, 6–19 × 2.5–11 cm, on both sides sparsely to moderately strigillose or hirtellous to glabrescent with pubescence often denser on principal veins, base acute or cuneate, apex acute or acuminate; secondary veins 5–12 pairs; stipules generally persistent, spatulate to pandurate, 4–7 mm, strigillose to glabrescent, apex spreading, rounded. Inflorescence paniculate, pyramidal, 20–30 × 20–30 cm, branched to 2 or 3 orders, densely strigillose, pedunculate; peduncle ca. 4.5 cm; bracts linear, spatulate, or lanceolate, 1–3 mm, acute. Flowers subsessile. Calyx strigillose; hypanthium portion turbinate, ca. 1 mm; limb lobed nearly to base; lobes lanceolate to triangular, 1–1.5 mm. Corolla white to cream, yellowish white, salverform or tubular, glabrous outside; tube 5–7 mm, white villous inside; lobes narrowly oblong to oblanceolate, 2–2.5 mm, obtuse to rounded. Anthers linear-lanceolate, exserted, 1.3–2 mm, at base 2-lobed; filaments ca. 1.5 mm. Stigma 2-lobed, 1–1.2 mm. Capsule subglobose, 2.5–3 mm in diam., pubescent. Fl. and fr. Mar–Nov.

Forests in ravines, forest margins; 1500–2800 m. Xizang (Mé-dog), Yunnan [Bhutan, India].

**28. *Wendlandia subalpina* W. W. Smith, Notes Roy. Bot. Gard. Edinburgh 9: 142. 1916.**

高山水锦树 gao shan shui jin shu

Shrubs, tufted to prostrate, 0.3–1 m tall; branches subterete, puberulent. Leaves opposite, subsessile; petiole to ca. 1 mm, glabrescent; blade drying leathery, ovate or suborbicular, 0.4–1 × 0.3–0.6 mm, glabrescent on both surfaces, base obtuse to cuneate, apex obtuse, subacute, or shortly acuminate; secondary veins indistinct; stipules deciduous, triangular, ca. 1 mm, glabrescent, apex erect, apparently acute. Inflorescences paniculate to cymose, 6–12-flowered, 0.6–1 × 0.6–1 cm, branched to

2 orders, puberulent, pedunculate; peduncle ca. 0.2 cm; bracts ca. 1 mm; pedicels 2–3 mm. Flowers pedicellate. Calyx puberulent; hypanthium portion ellipsoid, ca. 1.5 mm; limb deeply lobed; lobes triangular or lanceolate, 1.5–2 mm. Corolla white or pale yellow, tubular, outside glabrous; tube ca. 2.5 mm; lobes linear-oblong, ca. 3.5 mm. Filaments ca. 3 mm; anthers linear-lanceolate, ca. 2 mm, exserted. Stigma 2-lobed, ca. 1.2 mm. Capsules subglobose, 2–2.5 mm in diam., pubescent. Fl. May–Jul, fr. Sep–Oct.

- Open spaces or thickets on mountain slopes; 1800–3100 m. Yunnan.

**29. *Wendlandia tinctoria* (Roxburgh) Candolle, Prodr. 4: 411. 1830.**

染色水锦树 ran se shui jin shu

*Rondeletia tinctoria* Roxburgh, Fl. Ind. 2: 134. 1824.

Shrubs or trees, to 6 m tall; branches somewhat flattened to terete or quadrangular, densely puberulent, velutinous, or hirtellous usually becoming glabrescent. Leaves opposite; petiole 0.5–2 cm, densely puberulent or strigillose to glabrous; blade drying papery to leathery, oblong-lanceolate, elliptic-ovate, or obovate, 5.5–20 × 2.5–10 cm, adaxially sparsely strigillose at least on principal veins to glabrous throughout, abaxially sparsely to moderately strigillose or tomentose to glabrescent, base acute to obtuse, apex acute to acuminate; secondary veins 10–12 pairs, occasionally with pubescent and/or foveolate domatia; stipules generally persistent, triangular to ovate, 3–5.5 mm, densely strigillose or puberulent to glabrescent, apex cuspidate, erect or slightly spreading with age. Inflorescences paniculate, pyramidal in outline, 9–17 × 9–22 cm, branched to 2–4 orders, densely strigillose, pilosulous, velutinous, tomentose, hirtellous, or villosulous, sessile and tripartite or pedunculate; peduncle 0.8–4 cm; bracts linear to narrowly elliptic, 1–5 mm; pedicels to 0.8 mm. Flowers sessile to shortly pedicellate. Calyx densely hirtellous or pilosulous to glabrous; hypanthium portion subglobose to ellipsoid or turbinate, 0.8–1 mm; limb lobed nearly to base; lobes spatulate, triangular, or lanceolate, 0.8–1 mm. Corolla white, tubular-funnelform, outside glabrous and/or variously densely villosulous or strigillose; tube 3–4 mm, pilose in throat; lobes elliptic to ovate, 0.8–1 mm. Anthers oblong, ca. 0.5 mm, subsessile, partially exserted. Stigma 2-lobed, 0.5–0.8 mm. Capsules ovoid, ca. 1.5 × 2–2.5 mm, hirtellous to glabrous. Fl. and fr. Jan–Dec.

Dry sparse forests, dense forests, or thickets in valleys, in ravines, or on mountain slopes; 200–2800 m. Guangxi, Guizhou, Yunnan [Bangladesh, Bhutan, India, Myanmar, Nepal, Thailand, Vietnam].

Cowan recognized seven infraspecific taxa of this species, with five found in China; two additional infraspecific taxa from China were described by F. C. How. In Cowan's circumscription, *Wendlandia tinctoria* subsp. *tinctoria* was widespread in India and also found in Bhutan, Myanmar, Nepal, and Thailand but not known from China.

- 1a. Inflorescences glabrous or puberulent; calyx glabrous or sparsely pubescent.
  - 2a. Corolla lobes strigose outside ..... 29d. subsp. *floribunda*
  - 2b. Corolla lobes glabrous outside ..... 29g. subsp. *orientalis*

- 1b. Inflorescences densely pilosulous or tomentose.
- 3a. Calyx with hypanthium portion glabrous, glabrescent, or puberulent, lobes glabrous, glabrescent, or pilosulous.
- 4a. Corolla lobes pilosulous outside ..... 29b. subsp. *barbata*
- 4b. Corolla lobes glabrous outside ..... 29f. subsp. *intermedia*
- 3b. Calyx hirtellous or pilosulous.
- 5a. Corolla lobes villosulous outside ..... 29a. subsp. *affinis*
- 5b. Corolla lobes glabrous outside.
- 6a. Calyx densely hirtellous ..... 29c. subsp. *callitricha*
- 6b. Calyx pilosulous or sparsely hirtellous ..... 29e. subsp. *handelii*

**29a. *Wendlandia tinctoria* subsp. *affinis*** F. C. How ex W. C. Chen, Acta Phytotax. Sin. 21: 389. 1983.

毛冠水锦树 mao guan shui jin shu

Inflorescence densely tomentose. Calyx hirtellous or pilosulous. Corolla lobes villosulous outside. Fl. and fr. Feb–Jun.

• Forests or thickets in valleys or on mountain slopes; 700–1400 m. Guangxi (Longzhou), Yunnan.

In the protologue, this taxon is treated as “subsp.” in the text (both key and description) but its figure is labeled “var.”

**29b. *Wendlandia tinctoria* subsp. *barbata*** Cowan, Notes Roy. Bot. Gard. Edinburgh 16: 268. 1932.

粗毛水锦树 cu mao shui jin shu

Inflorescence densely tomentose. Calyx with hypanthium portion glabrous or glabrescent, lobes glabrous or pilosulous. Corolla lobes pilosulous outside. Fl. and fr. Feb–Nov.

Thickets or forests in valleys; 1000–1800 m. Guangxi, Yunnan [Vietnam].

**29c. *Wendlandia tinctoria* subsp. *callitricha*** (Cowan) W. C. Chen, Acta Phytotax. Sin. 21: 389. 1983.

厚毛水锦树 hou mao shui jin shu

*Wendlandia tinctoria* var. *callitricha* Cowan, Notes Roy. Bot. Gard. Edinburgh 16: 265. 1932.

Inflorescence densely tomentose. Calyx densely hirtellous. Corolla lobes glabrous outside. Fl. and fr. year-round.

Forests or thickets on mountain slopes or in ravines; 400–2800 m. Guangxi, Yunnan [Myanmar].

**29d. *Wendlandia tinctoria* subsp. *floribunda*** (Craib) Cowan in Craib, Fl. Siam. 2: 23. 1932.

多花水锦树 duo hua shui jin shu

*Wendlandia glabrata* Candolle var. *floribunda* Craib, Bull. Misc. Inform. Kew 1911: 386. 1911; *W. floribunda* (Craib) Craib.

Inflorescence glabrous or puberulent. Calyx glabrous or sparsely puberulent. Corolla lobes strigillose outside. Fl. Jul.

Dry sparse forests on mountain slopes; ca. 1100 m. Yunnan (Menglian) [Myanmar, Thailand].

**29e. *Wendlandia tinctoria* subsp. *handelii*** Cowan, Notes Roy. Bot. Gard. Edinburgh 16: 267. 1932.

麻栗水锦树 ma li shui jin shu

Inflorescences densely pilosulous. Calyx pilosulous or sparsely hirtellous. Corolla lobes glabrous outside. Fl. and fr. Mar–Dec.

• Forests or thickets on mountain slopes or in ravines; 200–1900 m. Guangxi (Wuming), Guizhou (Wangmo), Yunnan.

**29f. *Wendlandia tinctoria* subsp. *intermedia*** (F. C. How) W. C. Chen, Acta Phytotax. Sin. 21: 390. 1983.

红皮水锦树 hong pi shui jin shu

*Wendlandia tinctoria* var. *intermedia* F. C. How, Sunyatsenia 7(1–2): 43. 1948.

Inflorescence densely tomentose. Calyx with hypanthium portion glabrous or puberulent, lobes pilosulous. Corolla lobes glabrous outside. Fl. and fr. Mar–May.

• Forests or thickets in valleys; 1400–1600 m. Yunnan.

**29g. *Wendlandia tinctoria* subsp. *orientalis*** Cowan, Notes Roy. Bot. Gard. Edinburgh 16: 268. 1932.

东方水锦树 dong fang shui jin shu

Inflorescence glabrous or puberulent. Calyx glabrous or rarely sparsely puberulent. Corolla lobes glabrous outside. Fl. Mar–May, fr. Apr–Oct.

Thickets or forests on mountains; 200–2100 m. Guangxi, Yunnan [India, Myanmar, Thailand].

**30. *Wendlandia uvariifolia*** Hance, J. Bot. 8: 73. 1870.

水锦树 shui jin shu

Shrubs or trees, 2–15 m tall; branches terete to subquad-rangular, tomentulose, pilosulous, or hirsute, often with pubescence of two or more types. Leaves opposite; petiole 0.5–3.5 cm, densely ferruginous hirtellous or -pilosulous; blade drying papery, broadly elliptic, elliptic-oblong, ovate, or oblong-lanceolate, 7–26 × 4–14 cm, adaxially sparsely hirtellous, hispidulous, or scaberulous on lamina and moderately to densely tomentulose to strigillose along principal veins, abaxially moderately to densely hirtellous to pilosulous, base acute to obtuse, apex shortly to abruptly acuminate; secondary veins 8–12 pairs; stipules persistent or sometimes deciduous, obovate to pandurate, 5–12 × 5–12 mm, hispid, apex spreading to reflexed, rounded. Inflorescences paniculate, pyramidal in outline, 10–20 × 10–20 cm, branched to 2–4 orders, densely tomentulose, pilosulous, and/or hirtellous, sessile and tripartite or pedunculate; peduncle 1–4 cm; bracts linear-lanceolate to spatulate, 1–4 mm. Flowers sessile or subsessile. Calyx densely grayish pilose, -strigose, -hirtellous, -tomentose, or subglabrous (subsp. *pilosa*); hypanthium obconic, ca. 0.8 mm; limb lobed nearly to

base; lobes triangular to lanceolate, ca. 1 mm. Corolla white, tubular-funnelform, glabrous outside; tube 2.5–3 mm, inside upper part and throat white hirsute; lobes oblong to elliptic, ca. 1 mm. Anthers elliptic, ca. 0.8 mm, subsessile, partially exerted. Stigma 2-lobed, ca. 0.3 mm. Capsules subglobose, 1–2 mm in diam., densely strigillose to strigose. Fl. Jan–May, fr. Apr–Oct.

Thickets, forests, or forest margins on mountains or hill slopes, in ravines, or at streamsides; below 100–1200 m. Guangdong, Guangxi, Guizhou, Hainan, Taiwan, Yunnan [Vietnam].

Cowan discussed in detail the wide morphological variability in this species, in both vegetative and flower characters.

- 1a. Calyx pilose or subglabrous ..... 30b. subsp. *pilosa*  
 1b. Calyx densely grayish white hirsute, -strigose, -tomentulose, or -strigillose.  
 2a. Leaves rather narrow, elliptic-oblong or oblong-lanceolate, pilosulous abaxially ..... 30a. subsp. *chinensis*  
 2b. Leaves wider, broadly elliptic or ovate, densely grayish brown pilosulous abaxially ..... 30c. subsp. *uvariifolia*

**30a. *Wendlandia uvariifolia* subsp. *chinensis*** (Merrill) Cowan, Notes Roy. Bot. Gard. Edinburgh 16: 288. 1932.

中华水锦树 *zhong hua shui jin shu*

*Wendlandia chinensis* Merrill, Philipp. J. Sci. 15: 257. 1919.

Leaves rather narrow, elliptic-oblong or oblong-lanceolate, pilosulous abaxially. Calyx densely grayish white hirsute, -strigose, -tomentulose, or -strigillose. Fl. Mar–Apr, fr. Apr–Jul.

• Forests or thickets in ravines or on hill slopes; below 100–600 m. Guangdong, Guangxi, Hainan.

**30b. *Wendlandia uvariifolia* subsp. *pilosa*** W. C. Chen, Acta Phytotax. Sin. 21: 393. 1983.

疏毛水锦树 *shu mao shui jin shu*

Leaves densely pilosulous abaxially. Calyx pilose or subglabrous. Fl. Nov.

• Forests; ca. 900 m. Yunnan (Mengla).

**30c. *Wendlandia uvariifolia* subsp. *uvariifolia***

水锦树(原亚种) *shui jin shu* (yuan ya zhong)

*Wendlandia dunniana* H. Léveillé; *W. rotundifolia* Handel-Mazzetti; *W. uvariifolia* subsp. *dunniana* (H. Léveillé) Cowan; *W. uvariifolia* subsp. *rotundifolia* (Handel-Mazzetti) Cowan; *W. uvariifolia* subsp. *rufula* Cowan; *W. uvariifolia* subsp. *yunnanensis* Cowan.

Leaves broadly elliptic or ovate, densely grayish brown pilosulous abaxially. Calyx densely grayish white hirsute, -strigose, -tomentulose, or -strigillose. Fl. Jan–May, fr. Apr–Oct.

Thickets, forests, or forest margins on mountains or at streamsides; below 100–1200 m. Guangdong, Guangxi, Guizhou, Hainan, Taiwan, Yunnan [Vietnam].

**31. *Wendlandia villosa*** W. C. Chen, Acta Phytotax. Sin. 21: 388. 1983.

毛叶水锦树 *mao ye shui jin shu*

Shrubs or trees; branches densely villous becoming glabrescent. Leaves opposite; petiole 8–10 mm, villous becoming glabrescent; blade drying leathery, elliptic or elliptic-oblong, 4.5–13 × 2.5–6 cm, adaxially sparsely strigose or glabrous, abaxially densely yellowish brown villous, base cuneate, apex broad then shortly acuminate; secondary veins 7–9 pairs; stipules generally persistent, triangular to ovate, ca. 6 mm, villous, apex erect, cuspidate. Inflorescence paniculate, pyramidal in outline, 9–12 × 6–11 cm, branched to 2 or 3 orders, densely yellowish brown villosulous to -hirtellous, sessile and tripartite or pedunculate; peduncle ca. 3 cm; bracts lanceolate, ca. 1.5 mm. Flowers sessile or subsessile. Calyx densely hirtellous or villosulous; hypanthium portion ellipsoid, ca. 0.8 mm; limb lobed nearly to base; lobes lanceolate, 0.8–1 mm, ciliate. Corolla tubular-salverform; tube 3–4 mm, outside and inside glabrous; lobes elliptic to ovate, ca. 1 mm, densely villosulous or hirtellous outside. Anthers elliptic, ca. 0.7 mm, subsessile, partially exerted. Stigma 2-lobed, ca. 0.2 mm. Capsules not seen. Fl. Apr.

• Forests. Yunnan.

## 97. XANTHOPHYTUM Reinwardt ex Blume, Bijdr. 989. 1826–1827.

岩黄树属 *yan huang shu shu*

Chen Tao (陈涛); Charlotte M. Taylor

*Paedicalyx* Pierre ex Pitard; *Xanthophytopsis* Pitard.

Small trees, shrubs, or subshrubs, sometimes unbranched (i.e., monocaulous), unarmed, often fleshy; young growth usually densely sericeous to lanate, hirsute, or tomentose with trichomes drying golden yellow to ferruginous. Raphides present. Leaves opposite, isophyllous [or sometimes markedly anisophyllous], without domatia; stipules persistent or deciduous, interpetiolar, generally triangular or somewhat leaflike, sometimes markedly parallel-veined or -fibrous, entire or 2-lobed. Inflorescences axillary, cymose to paniculate or subcapitate, several to many flowered, sessile to pedunculate, bracteate or bracts reduced. Flowers sessile to pedicellate, bisexual, distylous or monomorphic, at least sometimes fragrant. Calyx limb shallowly to deeply 5-lobed; lobes sometimes unequal on an individual flower. Corolla white, yellow, or purple, tubular to funnelform, inside with pubescent ring in upper part of tube; lobes 5, valvate in bud. Stamens 5, exerted or included, inserted near middle to base of corolla tube; filaments reduced to developed; anthers apparently dorsifixed. Ovary 2-celled, ovules numerous in each cell on peltate placentas attached at middle of septum; stigmas clavate to 2-lobed, included or exerted. Infructescences often with peduncle, axes, and pedicels elongating notably. Fruit indehiscent, schizocarpous, or capsular, ovoid to subglobose, dry, with calyx limb persistent or deciduous, sometimes splitting

septicidally into 2 indehiscent mericarps or loculicidally dehiscent valves, these each 1-celled, ellipsoid to plano-convex, each with numerous seeds; seeds small, angled, smooth, often brown.

About 30 species: China, Indonesia (including Borneo, with most of the species), Laos, Malaysia, New Guinea, Pacific islands (Fiji), Philippines, Vietnam; four species in China.

*Xanthophytum* was reviewed for China by Chun and F. C. How (Sunyatsenia 4: 10–15. 1939, as *Paedicalyx*) and then by H. S. Lo (Bull. Bot. Res., Harbin 6(4): 21–33. 1986), who formally synonymized *Xanthophytopsis* and *Paedicalyx* in this region based on previous comments by Bakhuizen but making the necessary combinations. Axelius (Blumea 34: 425–497. 1990) provided the only comprehensive review of *Xanthophytum*. She recognized four types of trichomes characteristic of the genus (loc. cit.: 427, f. 1); also notable in *Xanthophytum* are the fruit with numerous tiny seeds apparently enclosed in drupaceous locules or mericarps, and the stamen filaments that are often fused to the corolla only at the base and appear free or nearly free. Several authors have described the fruit as drupaceous and splitting, but the fruit morphology apparently corresponds better to schizocarpous in the terminology used in this treatment. Axelius observed also that distyly in *Xanthophytum* was apparently not noted by Chinese authors, resulting in somewhat confused descriptions of floral morphology.

- 1a. Inflorescences subcapitate to congested-cymose, subsessile to shortly pedunculate, with peduncles to 0.5 cm in flower, sometimes to 1 cm at fruiting; leaves with secondary veins 9–16 pairs ..... 3. *X. kwangtungense*  
 1b. Inflorescences subcapitate to laxly cymose or paniculate, pedunculate with peduncles 0.5–11 cm; leaves with secondary veins 9–30 pairs.  
 2a. Fruit septicidally dehiscent; inflorescences laxly cymose to paniculate; peduncles 4–11 cm; leaves with secondary veins 9–15 pairs ..... 2. *X. balansae*  
 2b. Fruit indehiscent; inflorescences subcapitate to laxly cymose or paniculate; peduncles 0.5–6 cm; leaves with secondary veins 14–30 pairs.  
 3a. Inflorescences subcapitate; corolla tube 2–2.2 mm ..... 1. *X. attopevense*  
 3b. Inflorescences laxly cymose to paniculate; corolla tube 1.5–2 mm ..... 4. *X. polyanthum*

**1. *Xanthophytum attopevense*** (Pierre ex Pitard) H. S. Lo, Bull. Bot. Res., Harbin 6(4): 32. 1986.

琼岛岩黄树 qiong dao yan huang shu

*Paedicalyx attopevensis* Pierre ex Pitard in Lecomte, Fl. Indo-Chine 3: 88. 1922.

Shrubs or herbs, to 1 m tall; branches flattened to subterete, densely sericeous to pilose. Petiole 0.2–2 cm, densely sericeous; leaf blade drying membranous or thinly papery, narrowly elliptic or oblanceolate-oblong, 10–20 × 3.5–6 cm, adaxially moderately to sparsely villous to hirsute, abaxially rather densely hirtellous to hirsute on veins and densely sericeous on lamina, base acute and often decurrent, apex acuminate or shortly acuminate; secondary veins 17–30 pairs; stipules persistent, ovate or lanceolate, 12–17 × 4–8 mm, sericeous or pilose to glabrescent, longitudinally veined, caudate or acuminate. Inflorescences subcapitate, densely sericeous; peduncles 0.5–1.5 cm; heads subglobose, 0.5–1 cm in diam.; bracts triangular, 1.5–3 mm; bracteoles reduced; pedicels 0–1 mm. Calyx densely villous or strigose; ovary portion obconic, ca. 1.5 mm; lobes obovate, 1–2.5 mm, sometimes unequal, glabrescent. Corolla white, outside pilosulous at least on lobes; tube 2–2.2 mm; lobes oblong-lanceolate, ca. 1 mm. Fruit indehiscent, subglobose to didymous, ca. 2 × 2.5 mm, hirsute to sericeous. Fl. Jan–Mar, fr. May–Aug.

Dense forests. Hainan [Laos, Vietnam].

This species is circumscribed here following Axelius; many of the specimens that were included in this species by Chinese authors are here separated in *Xanthophytum polyanthum*.

**2. *Xanthophytum balansae*** (Pitard) H. S. Lo, Bull. Bot. Res., Harbin 6(4): 31. 1986.

长梗岩黄树 chang geng yan huang shu

*Xanthophytopsis balansae* Pitard in Lecomte, Fl. Indo-Chine 3: 90. 1922.

Shrubs, ca. 1 m tall; stems subterete, densely sericeous. Petiole 5–15 mm, puberulent to sericeous; leaf blade drying membranous or thinly papery, green above, pale brown below, elliptic or elliptic-oblong to lanceolate, 9–17.5 × 2.5–5 cm, adaxially glabrous or sparsely strigose, abaxially densely sericeous, base cuneate to acute and often decurrent, apex acute; secondary veins 9–15 pairs; stipules persistent, narrowly ovate, ca. 10 × 3 mm, acuminate. Inflorescence laxly cymose to paniculate, pilose to strigillose; peduncles flexuous, 4–11 cm; branched portion broadly pyramidal, 2–7 × 2–10 cm; bracts elliptic, up to 2.5 × 9 cm, acute; bracteoles reduced; pedicels 1–2 mm. Flowers unknown. Fruit septicidally dehiscent, subglobose to ovoid, ca. 2 mm in diam., densely strigillose to strigose, with persistent calyx lobes obovate or oblanceolate, 1–3 × ca. 1 mm, ciliate; seeds yellow. Fl. and fr. Jun–Oct.

Streamsides in dense forests. Guangxi (Shiwan Dashan) [N Vietnam].

**3. *Xanthophytum kwangtungense*** (Chun & F. C. How) H. S. Lo, Bull. Bot. Res., Harbin 6(4): 32. 1986.

岩黄树 yan huang shu

*Xanthophytopsis kwangtungensis* Chun & F. C. How, Sunyatsenia 4: 14. 1939.

Shrubs, 0.5–1 m tall; branches flattened to subterete, densely sericeous to tomentose-pilose. Petiole 0.5–3 cm, densely sericeous to pilose; leaf blade drying papery, elliptic, elliptic-oblong, or ovate, 5–20 × 2.5–7 cm, adaxially glabrous or sparsely pilose at least along veins, abaxially densely sericeous or sericeous-villous, base cuneate to acute and usually long decurrent, apex acuminate; secondary veins 9–16 pairs; stipules drying membranous, persistent, ovate to triangular, 9–15 × 5–7

mm, sericeous or pilose to glabrescent, parallel-veined, acute to acuminate or bilobed for up to 1/2, margins often ciliolate. Inflorescences subcapitate to congested-cymose, many flowered, densely strigose to strigillose; peduncles 0.1–0.5 cm; flowering portion subglobose, ca. 1 cm in diam.; bracteoles linear-lanceolate, ca. 2 mm; pedicels 0–3 mm. Calyx densely strigillose to sericeous; ovary portion ellipsoid, 1.1–1.2 mm; limb lobed essentially to base, glabrous internally; lobes subspatulate to ovate or oblanceolate, 1.2–2.5 mm, obtuse to rounded, often ciliate. Corolla pale yellow, campanulate-funnelform, outside pilosulous at least on lobes; tube 2.2–2.3 mm; lobes ovate-triangular to spatulate, 1.2–1.3 mm, obtuse to acute. Inflorescences often borne at lower leaf nodes or below leaves, with peduncles up to 1 cm, pedicels up to 2 mm. Fruit capsular, subglobose to ovoid, ca. 2 mm in diam., strigillose to sericeous. Fl. May, fr. Jul–Oct.

Wet places in forests. SE Guangxi, S Yunnan (Hekou) [Vietnam].

The calyx lobe measurements given here are based on Chinese specimens studied and on H. S. Lo (in FRPS 71(1): 24. 1999); Axelius (Blumea 34: 467–469. 1990) reported that these range up to 4.1 mm throughout the range of the species (i.e., in Vietnam). Several specimens of this species, in particular *W. T. Tsang* 23975 and 24532, were distributed as "*Xanthophytum chinense* Merrill," but that name has not been published.

**4. *Xanthophytum polyanthum*** Pitard in Lecomte, Fl. Indo-Chine 3: 91. 1922.

多花岩黄树 duo hua yan huang shu

Low shrubs, ca. 0.5 m, little branched; branches weakly angled or subterete, sometimes rather stout, densely sericeous. Petiole 0.8–5 cm, densely sericeous; leaf blade drying papery, lanceolate to elliptic, elliptic-oblong, or oblanceolate, 9–30 × 3.5–8 cm, adaxially sparsely or moderately hirtellous to villous to subglabrous, abaxially densely pilose to sericeous, base cuneate to acute and usually decurrent, apex acute to acuminate; secondary veins 14–25 pairs; stipules persistent, lanceolate to ovate, 1.8–2.3 × 0.6–0.9 cm, sericeous to glabrescent, acuminate or lobed for up to 1/3. Inflorescences laxly paniculate or cymose, densely villous to hirtellous; peduncles 2–6 cm; branched portion pyramidal, 1.5–5 × 2–5 cm; bracts triangular, 2–5 mm; bracteoles narrowly triangular, 1–2 mm; pedicels 0–3 mm. Calyx densely villosulous; ovary portion subglobose to ellipsoid, ca. 0.5 mm; limb lobed nearly to base, glabrous inside; lobes spatulate to ovate or obovate, 0.6–2.1 mm, obtuse to rounded. Corolla tubular to funnelform, glabrous or with a few stout hairs outside; tube 1.5–2 mm; lobes 0.5–1.5 mm, acute. Fruit indehiscent or perhaps tardily splitting septically, ellipsoid to subglobose or didymous, 1.5–3 mm, villosulous to hirtellous. Fl. Feb, fr. Apr.

Wet forests; ca. 1400 m. Hainan (Jianfeng Ling) [N Vietnam].

The specimens described here were included by Chinese authors in *Xanthophytum attopevense* but are here separated following Axelius (Blumea 34: 470–472. 1990).